Kaupang Excavation Project
Publication Series, Volume 3

Norske Oldfunn XXIV

THINGS FROM THE TOWN

EDITED BY DAGFINN SKRE

Things from the Town
Artefacts and Inhabitants in Viking-age Kaupang

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Introduction

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DAGFINN SKRE

The publication of volumes like this, with chapters that discuss the important classes of finds from an excavation, is a classic genre of Archaeology. It is particularly familiar with publications of the often find-rich excavations of Scandinavian Viking-period towns. From Charlotte Blindheim's excavations at Kaupang, six volumes were published in a series of *Kaupang-funnene* [*The Kaupang Finds*] (Blindheim, Heyerdahl-Larsen et al. 1981; Hougen 1993; Blindheim and Heyerdahl-Larsen 1995; Tollnes 1998; Blindheim, Heyerdahl-Larsen et al. 1999; Resi and Askvik 2008), four of which are purely finds reports. Equivalent publications from Ribe have appeared in the series *Ribe Excavations 1970–76* (5 vols. to 2004) and *Ribe Studier* [*Ribe Studies*] (2 vols., 2006), from Birka in the series *Birka: Untersuchungen and Studien* [*Birka: Investigations and Studies*] (8 vols. to 1989) and *Birka Studies* (8 vols. to 2004), and from Hedeby primarily in the series *Berichte über Ausgrabungen in Haithabu* [*Reports of the Excavations in Haithabu*] (36 vols. to 2007), but also in certain volumes in the series *Die Ausgrabungen in Haithabu* [*The Excavations in Haithabu*] (13 vols. to 2008).

It is thus a well tried and tested genre that we have joined both in the present volume and in the previous volumes of the *Kaupang Excavation Publication Series*. Awareness of genre is important in a publication project of this kind, and it is equally important to consider whether that genre should be modified in order to meet the objectives of the project and to keep up with the contemporary research agenda and publication media. We have made certain reflections on these two points that may be of general interest.

The genre of the "finds report" was first established in the large, thoroughly illustrated, typological general surveys of the later 19th century. The three Scandinavian countries were at the forefront, starting with Oscar Montelius' *Sveriges forntid* [*The Antiquity of Sweden*] of 1872–4. This was followed by Oluf Rygh, with *Norske Oldsager ordnede og forklarede* [*Norwegian Antiquities classified and explained*] in 1885, and Sophus Müller in 1888–95, with his *Ordning of Danmarks Oldsager* [*Classification of the Antiquities of Denmark*]. In these works, the basic typology and chronology of artefacts in the three Scandinavian countries were established, to which later contributions can be regarded as supplements and refinements. In the case of Viking Period archaeology, Jan Petersen's works (1919, 1928, 1951) have been crucially important.

The genre ranges markedly from these large and thoroughly systematic finds publications on a national scale, to those that concern themselves with the objects from a particular area or site. The degree of systemization also varies greatly, from the completely systematized works of that kind, to those that contain only a provisional description of the objects from an excavation and whose primary objective is to make the material known to specialists on the various types of find that have been made.

Several of the purposes of the finds report have now been achieved, either fully or in part in a different medium: internet-accessible databases. In the most advanced examples of the kind, such as that of Sweden's National Historical Museum (*http://mis.historiska.se/mis/sok/sok.asp*), one can search by find-place, artefact-type, period etc., and open 3-D pictures of objects. There is little doubt that this sort of service will be enhanced and developed so that before long this will be a much better medium than print for those who wish to gain an overview of objects of a given type, or from a particular period, site or area.

This development means that it is necessary for those of us who edit finds reports to think right through the question of how the genre should be developed. To begin with, it is essential not to consume page-space with printed data that the reader can retrieve more easily by searching on the museum databases available on internet. More important, however, is to consider what virtues the printed form has, and then seek to develop these.

The great strength of the printed finds report over any net-search is, in my opinion, that the systematization of the finds is both qualified and contextualized. Qualification resides in the fact that while an internet-search provides little space for discussion, or in any event leaves a great deal of work to the user, the author of a printed text can explain in detail the premises of his or her systematization and propose a degree of confidence in his or her conclusions; perhaps, indeed, evaluate alternatives. The expert author can put the finds from the site in question into a context and so raise the publication from a pure systematization of the material up to a level of engagement with problems that is far beyond the basic information that one can expect to find in a database: artefact-type, provenance and date.

If finds reports are to be justified in the future, their editors and authors must strive to enhance this quality, and not spend their resources on objectives that are better served by museum databases, such as the printing of large and detailed catalogues.

These virtues of the print medium coincide nicely with the twin objectives of the current project. The first was that we should produce new empirical data that would be able to contribute to new knowledge of Kaupang; the second that we sought to "develop new ways of approaching the Scandinavian Viking Period and to produce new elements to the overall picture of that era" (Skre 2007b:15–16). In the work on these volumes, importance has been attached to the aim that each book should include *both* basic and detailed empirical studies *and* general discussions of problems and conclusions.

In order to achieve these goals, we have selected authors who are not only the leading experts in their fields but who have also shown that they can make the fruits of their specialist knowledge relevant to the wider archaeological debate. The editor, regarding the diversity that characterizes the chapters of this book as one of its virtues, has not therefore imposed directions on the types of discussion the authors should follow in their papers. Certain general guidelines were given as to what information the catalogues of finds in each chapter should include, but here too the authors have had a degree of freedom to design the catalogues in accordance with what they consider necessary and with the normal practice within that particular field. Conformity in either respect would have restricted the authors, and the result would have been a less interesting book.

This volume

In concluding each volume, I, as editor, have contributed a final general discussion that is based, on the whole, upon the preceding chapters in the book. In Volumes 1 and 3 in particular, my contributions have contained quite extensive empirical analyses. Although there has of course been a publication plan, it only gradually became clear to me precisely what these concluding chapters of mine would deal with as the other chapters were delivered by the authors; and this applies also with the present volume. All of the following chapters contain results that help to encircle the inhabitants of the town, their activities, their cultural affinities and their trading connexions, and these are the topics I discuss in Chapters 15 and 16.

The analysis of activities on sites with a complex stratigraphy depends upon the possibility of distinguishing those finds that derive from activities within an excavated building from those that have been deposited there more or less by chance. The use of the *single-context* method of recording at Kaupang means that we can securely identify occupation deposits in the six buildings excavated. These layers were deposited as a result of the use of the buildings and we can consequently link their composition and finds to that use.

Together with the construction, furnishing and dating of the buildings, the stratigraphy and finds thus constitute sources of evidence for the use of the buildings. Particularly informative is the composition of the layers, with micromorphological analyses of occupation deposits in four of the buildings having been carried out (Milek and French 2007). Water-sieving of all of the excavated soil has meant that the collection of finds from these layers is greater and more representative than usual. The analysis of activity does not extend chronologically beyond c. AD 850 because later contexts have been disturbed by ploughing.

In the study of the trading contacts and the areas of origin of the inhabitants in Chapter 16, the context of the finds is less crucial. As a result, the large assemblage that has been gathered from surface survey and metal-detecting is of great value in that investigation. Metal-detecting has produced a large number of finds of precious metal. These artefacts are often of ethnic significance, and their origins and dating are easier to determine than those of many other types of find. The subject of Chapter 16 can thus be carried through to the abandonment of the town around the year 930.

In the 17th and final chapter, some of what we consider to be the most important strands in the three volumes that have been published in this series are brought together. Many other specific discoveries in these three volumes, meanwhile, point the way to further work, and we hope that other scholars will follow those up. We also hope that other researchers will undertake further work on those categories of archaeological find that we have not prioritized for publication, such as all of the ironwork, the timber from the wells, and some smaller groups of material.

While this book was being put together, the author of Chapter 10, our good colleague Alan Vince, sadly passed away in February 2009 after a brief period of illness. He had delivered the final version of his chapter and figures for this book. The proof of his chapter has been read by John Hines.

The completion of the publication plan

With this volume, the publication resulting from the research project that began with the excavations at Kaupang of 1998–2003 is concluded. The one item remaining is a doctoral thesis (Pedersen, in prep.), which at the time of writing has approved, and which will be published in revised form as a fourth volume. As that will be a monograph, my own editorial duties end with this third volume. We have hereby succeeded in publishing the studies that were announced in Volume 1 (Skre 2007b:13, 2008b:11), although for practical and financial reasons they have been grouped in fewer volumes than originally planned (Skre 2007a; 2008a).

That we have fulfilled the goals of the ambitious research and publication plan that was devised in 2003 is due first and foremost to the dedicated authors and collaborators in this project. None of this could ever have been undertaken without the financial support of our loyal grant-givers, who are listed on the colophon page of this book. I wish to take this opportunity to offer sincere and heartfelt thanks to all of these. I wish also to express special gratitude to Professor John Hines who has translated, revised or checked the language in every chapter, and thereby made an invaluable contribution to the consistency of the three volumes in this series.

Introduction to the Site 2

LARS PILØ, DAGFINN SKRE

To make full use of this book, it will help the reader to know the most important results of the archaeological fieldwork at Kaupang. A comprehensive account of the results of the archaeological excavations and recording undertaken there from 1998 to 2003, as well as an overview of earlier fieldwork, has been published in volume 1 of this series (Skre 2007a). In that volume, Kaupang is additionally set into its local context of Skiringssal, and its relationship with south-western Scandinavia more widely is outlined. The main emphasis in what follows falls upon a description of the archaeological contexts of the artefactual finds from the fieldwork of 1998–2003.

The fieldwork of those years was the first stage of the Kaupang Excavation Project, which has been directed from the University of Oslo – also with the financial support of those institutions listed on the colophon page of this volume. In 1998–1999 only surveys and minor trial excavations were carried out. A major excavation of 1,100 sq m was carried out in the settlement area of Kaupang from 2000–2002, in addition to several minor excavations. From 1999 to 2001 the project undertook survey work and excavations at the neighbouring farmstead to Kaupang, Huseby. Finally a small investigation was undertaken of the harbour sediments of Kaupang in 2003.

In 2003 the second stage of the project also got underway, with a group consisting of thirty scholars from Norway, Sweden, Denmark, the United Kingdom and Germany working on Kaupang and Skiringssal. Besides the publication of the results of the excavations themselves (included in Skre 2007a), the aim of this phase of the project has been to publish the most significant aspects of the artefactual finds, to pick up some of the most important questions posed by the finds and the results of the excavations, to construct a comprehensive picture of Kaupang and Skiringssal, and to place Kaupang in its contexts of Scandinavia and the North Sea region. The main focus of vol. 2 (Skre 2008a) was coinage and economy.

The present volume is the third volume from the work of these specialists. It is not the aim of the project however to publish the artefactual finds in their entirety; the material is available in its entirety to any interested scholar. An overview of the finds can be found in Pedersen and Pilø 2007:180-4.

2.1 Exploring Kaupang and Skiringssal 1867–1999

Kaupang is located in county Vestfold at the mouth of the Oslofjord. Vestfold means "West of the Fold", and Fold is the ancient name of the Oslofjord. Vestfold is the richest region of Norway in Viking-period archaeology with sites like Oseberg, Gokstad and Borre (Fig. 2.1).

The fertility of the Vestfold soil is one reason for its rich archaeology, the regions proximity to the main communication route of the period is another. The sailing route along the coast was followed by all maritime traffic along the northern shores of Skagerrak and through the fjords. Valleys led on to the fertile inner parts of Eastern Norway and further through woodlands up the mountain plateau of Hardangervidda, where hunting, iron extraction and other industries produced goods for trade. From a communicative point of view, Kaupang was ideally located.

2.1.1 The cemeteries

In 1867 Nicolay Nicolaysen, the first Norwegian field archaeologist, made Skiringssal his first major archaeological project. He excavated 79 barrows at Kaupang, 71 of them in what appeared to be the main cemetery called *Nordre Kaupang* (Fig. 2.2). All graves from this cemetery are cremations. Nicolaysen employed local workmen, and this affected the quality of the excavation. The workers found a large number of small artefacts, such as weights, but we

Figure 2.1 *Kaupang is located on the coast of county Vestfold, south-eastern Norway. Areas under cultivation in modern times are shaded green, largely reflecting the situation in the Viking Age. Map, Julie K. Øhre Askjem.*

Figure 2.2 *Settlements, cemeteries and single barrows in the Kaupang area. Light greed shading shows the extent of the settlement area, darker greed shading area with plot division. Shaded light brown areas represent the suggested, former extent of the various cemeteries. Contour interval 1 metre. Map, Anne Engesveen.*

have to assume that some nevertheless went missing, and that the grave assemblies from the excavation of 1867 probably are incomplete.

With Charlotte Blindheim's excavations of burials and settlement remains at Kaupang from 1950 to 1974 there was a new surge in Skiringssal research. It was Blindheim who revealed the remains of the urban site at Kaupang and retrieved a significant collection of archaeological finds which provided a basis for dating the site and for assessing the craft, trade and connexions evident there.

Blindheim discovered the cemetery of Bikjholberget, consisting entirely of flat graves except for one small mound. The original number of graves there is assumed to have been around 160 (Stylegar 2007:77). In the years 1950–7 Blindheim excavated 74 of these. Forty-eight of these burials were in boats – 33 boats in all. Thus several boats had more than one body in them; in two instances, four. Both the large number of boat-graves and the fact that all of the burials were inhumations makes Bikjholberget different from all other cemeteries in the Oslofjord area. The graves at Bikjholberget were also more richly furnished than those at Nordre Kaupang, and the amount of imported material was higher. Blindheim therefore drew the conclusion that Bikjholberget was the *merchant's* cemetery; the site where the traders of Kaupang were buried. Her excavation technique was more careful than Nicolaysen's, and her excavation team better qualified. The ratio of grave goods retrieved was presumably greater as a result. However, as was normal at that time, the fill was not sieved. Thus some smaller objects may have been lost. Many of the graves were disturbed by later burials, but in some areas the stratigraphical relationships were extremely complicated. In consequence, the association of some objects with specific graves can be uncertain.

A total number of 204 graves and stray finds that probably derive from graves are known from the Kaupang cemeteries. If one includes the empty barrows and barrows containing nothing but layers or patches of charcoal, the number of excavated graves is 237. If one includes unexcavated burial mounds, 407 graves (i.e. buried individuals) can be documented – assuming that the unexcavated mounds contain one grave each. Based on various types of information a total of 700 graves can be estimated in all (Stylegar 2007:77). However, there is no doubt that this number is still an underestimate. Many flat graves are probably still undetected, and a large number of graves have been removed over the centuries without any finds from them being brought to any museum. The actual number of graves within the Kaupang complex could have been about a thousand, as suggested by Blindheim (et al. 1981:65, cf. 1999:153-4).

Blindheim excavations 1950-57
Blindheim excavations 1956-67, 1970, 1974
MRE excavations 2000-2002
Non-excavated barrow
Excavated barrow
Cemetery
Settlement area
Area with plot-division
Bjønnes
Nordre Kaupang
Hagejordet
Bikjholberget
Lamøya
Søndre Kaupang
Vikingholmen
0
200 m

Of the 204 known burials from Kaupang, 116 contain closely datable artefacts. The first burials seem to have taken place around AD 800. Overall, there is a slight preponderance of burials of the first half of the 10th century as compared to the 9th. The general lack of burials with artefact-types dated to after c. AD 950 probably indicates that the cemeteries at Kaupang stopped being used regularly for burials somewhat before this time. Thus the apparently equal numbers of 9th- and 10th-century graves really conceal a much higher burial frequency in the later period. The barrow cemetery at Nordre Kaupang is distinguished by having a clear majority of graves from the first half of the 10th century.

To avoid the confusion resulting from the many different numbering systems that different excavators have applied to the Kaupang graves, a new series of numbers, each starting with Ka., has been allocated in the complete catalogue of excavated graves published by Stylegar (2007:103–28). This catalogue provides cross-references to all earlier numbering systems. In the present publication all references to graves use Stylegar's numbering. For reference to a specific artefact within a grave a letter is added to the number, the same letter as in the original catalogue.

2.1.2 The settlement

Prior to 1956 there had been no reported finds from the settlement area (this section is based on Pilø 2007b). In 1956 Blindheim started excavations in what was later seen to be the northern part of the settlement area, and excavations continued here on almost an annual basis until 1967, leading cumulatively to the excavation of a site of 1,350 sq m (Fig. 2.4). A few minor excavations were conducted in other parts of the settlement area until 1984. The settlement excavations up to that year were published in full by Roar L. Tollnes (1998). These excavations documented structures that at the time were interpreted as the remains of houses, wells and jetties. In light of the more recent excavations however, those interpretations can now be questioned (Pilø 2007b). The main change is that the structures interpreted as houses are now considered to represent fences and stone foundations and supports at the lower ends of plots. Thousands of artefacts were recovered, including large quantities of imported material from most of northern Europe and from the Middle East.

For the times, the excavations of 1956–1974 were methodologically well conducted. The deposits were removed in spits and squares. An overall system of 2 x 2 m squares was employed. Spits were 10 cm thick. No, or very little sieving, took place, as was the custom at the time. The cultural deposits were generally termed "black earth" even though their colour and composition varied. Little emphasis was placed on stratigraphy. Since the deposits were removed in spits, it is now impossible, except in a few cases, to relate specific artefacts with certainty to the stratified layers documented in section drawings or photographs. For a more detailed presentation and evaluation of the evidence from the settlement area prior to 1998, see Pilø 2007b.

2.2 Fieldwork in the Kaupang settlement 1998–2003

In the spring of 1998 the preparations began for the excavations that would eventually take place from 2000 to 2003. Field surveys were undertaken every year from 1998 to 2002.

2.2.1 Research questions

The principal questions behind the fieldwork relate to two key topics (Skre 2007d): the debate over the first *urban sites* in Scandinavia – of which Kaupang appears to be an example; and the debate surrounding the *central places* of Scandinavia in the first millennium AD – of which Skiringssal appears to be one (see below).

The principal objective of the excavations planned at Kaupang was to decide whether Kaupang was one of the many seasonal market sites of this time or one of the very few towns established in the early Viking Period. With reference to the general objectives, the following five concrete research questions were defined as those that the fieldwork aimed to investigate:

- The character of the settlement – seasonal or year-round
- The layout of the settlement – possible plots, lanes, grouped buildings, open spaces
- Building-types
- The location and character of various forms of activity – trade, craft production, etc.
- The dating of the settlement, and possible changes in its activities and character

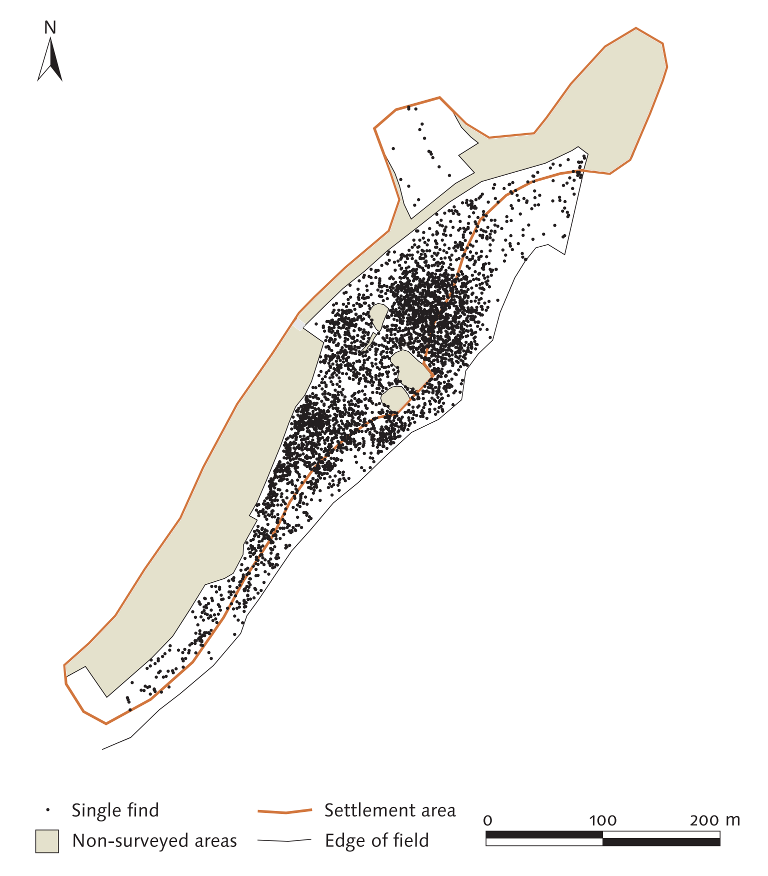
2.2.2 Overview

The fieldwork at Kaupang from 1998 to 2003 (Pilø 2007b) fell into two parts, with 1998–1999 as a pilot project period, which included surveys and limited trial trenching, and 2000–2003 being the main project period, which included a series of excavations in addition to continuing surveys. Geophysical mapping was also undertaken.

Surveys

Prior to 1998 excavations had only taken place in the northern part of the settlement area, and no systematic surveys of the entire settlement area had been undertaken. Very little was known about other parts of the settlement. Thus the surveys were designed to collect archaeological data over large parts of the settlement area (Fig. 2.3).

Figure 2.3 *Aggregated artefact recovery during field surveys 1998–2002. Illustration, Julie K. Øhre Askjem.*



The field surveys have led to the collection of 4,336 artefacts from the settlement area: 1,940 from fieldwalking and 2,396 by metal detection. The total area covered by the field surveys at Kaupang is approximately 62,500 sq m, most of which has been surveyed several times, both through fieldwalking and metal detecting. The total fieldwalked area is 60,000 sq m, while the total metal-detected area is 46,500 sq m.

The problem of displacement of artefacts due to ploughing and erosion in the slopes towards the Kaupang inlet was obvious even before the surveys started. Thus it is no longer possible to gain information on the location of activities based on the artefacts recovered from the ploughsoil, apart from on the central plateau. Even so the artefacts recovered have yielded important new evidence on the dating and the extent of the site as well as on the character of activities that took place there.

Only iron objects were not recorded during metal detecting – unless they could be identified by the archaeologists as dating to the Viking Age. During fieldwalking all materials were collected except non-tool flint, bone and iron (unless artefacts dating to the Viking Age could be identified).

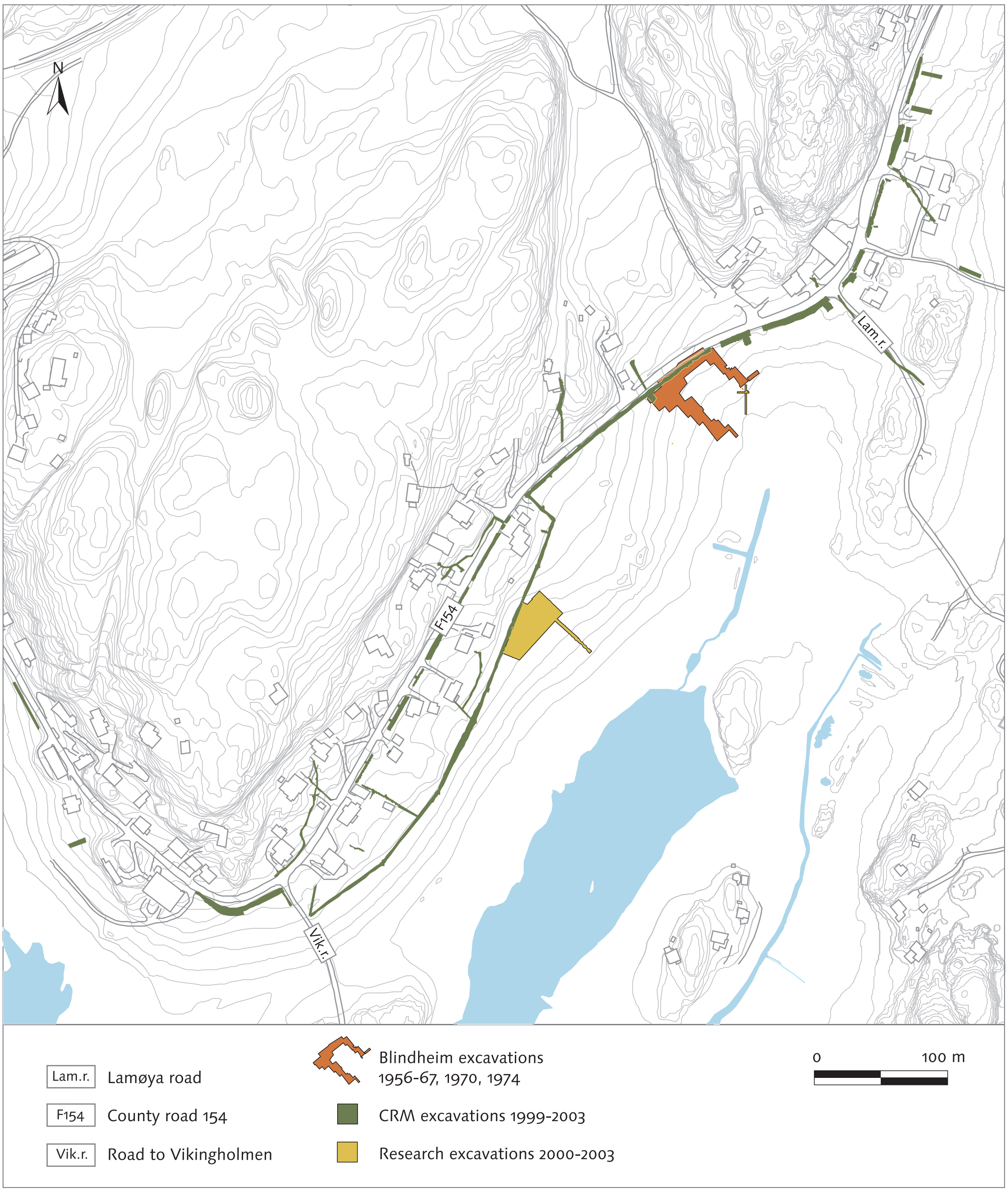
Excavations

The *main research excavation 2000–2002 (MRE)* was the key part of the fieldwork campaign at Kaupang (Figs. 2.4–6). The excavation site was chosen because it was centrally located in the settlement area and distant from the site of the 1956–1974 excavations. In addition it had relatively well-preserved cultural deposits and a high density of surface finds.

The excavation site covered 1,100 sq m, of which 400 sq m were excavated down to the original beach deposit. It was situated between 3.5 and 6 m above present sea-level, and thus included areas suitable for settlement, as the Viking-age sea-level is estimated to have lain c. 3.5 m above the present mark. It also included the Viking-age beach in front of the settled area. The excavation area of 1956–1974 was situated between 1.0 and 4.5 m above present sea-level.

Several *cultural resource management excavations (CRM)* took place from 2000–2003 too (Fig. 2.4). A large-scale excavation in areas affected by a new water and sewage system and a footpath was conducted in 2000, in advance of the MRE. This excavation was preceded by trial trenching in the autumn of 1999, covering 240 sq m within the site. The 2000 CRM excavations consisted of a series of trenches with a total length of 800 m. The trenches were normally 2–3 m wide, and the total excavation area covered 2,250 sq m. From 2000–2003 a number of additional shorter and narrower trenches had to be opened to allow connexions to be made between modern buildings and the new sewage system. These trenches had a total length of 650 m and covered an additional 610 sq m, bringing the total area excavated for CRM purposes at Kaupang in the years 1999–2003 to 3,100 sq m.

In effect, these trenches constituted a series of exploratory trenches all the way from the northern barrow cemetery through the entire settlement area to the southern barrow cemetery. The CRM excavations allowed new evidence to be gathered from parts of the settlement area which had previously



seen very little or no archaeological activity. However, due to the narrowness of the trenches and extensive disturbance in the areas along the modern road, valuable information was collected only here and there from these excavations.

A test excavation was undertaken in the *harbour area in 2003*, c. 1.5–2.5 m below the Viking-age sea-level (Fig. 2.4). Deposits which dated to the 9th century and possibly the early 10th century were found.

Method of excavation

The documentation method employed during the MRE was *single context* recording. Each layer and feature is recorded as a discrete individual context. The contexts are excavated in the reverse order to that in which they were deposited. Applying single-context recording at Kaupang was a demanding process. The cultural deposits in the settlement area are compressed and dry, and consist of humus, sand, silt and clay – except for the waterlogged deposits in some of the pits, which contain a broader selection of organic material. Many of the deposits were difficult to delimit, as they had been the object of intense bioturbation (disturbed by faunal activity, mainly earthworms) and leaching.

Stratified deposits were not expected in the area investigated for CRM reasons because extensive testing with augers showed only a dark homogene-

Figure 2.4 *The main excavations at Kaupang 2000–2003. Contour interval 1 metre. Map, Julie K. Øhre Askjem.*

Figure 2.5 *Plot-divisions in the MRE.*

ous deposit below the ploughsoil. However, as excavation quickly proved, stratified deposits were indeed present in the area next to where the MRE was to be conducted, even though auger testing had failed to identify them. In the CRM trench these deposits had to be excavated to a tight deadline, and full-scale stratigraphical excavation was not possible. This was unfortunate, and has made it difficult to correlate the layers and structures found in this excavation fully with those in the subsequent MRE.

All excavated deposits from intact contexts and from the later medieval plough layer in the MRE were water-sieved. The basic mesh width used was 5 mm. In addition, part of each intact context, never less than 20% of the total, was sieved through a 2 mm mesh. In all, about 120 cu m of cultural deposits were sieved in connexion with the MRE.

To enable the sufficiently precise location of artefacts retrieved from the water sieving of excavated deposits, layers greater than 1 sq m were separated into smaller units during excavation and recording, using 1 x 1 m squares, aligned with the national geographical grid system of Norway.

Full-scale sieving of the ploughsoil covering the MRE area was not possible, but measures were taken to recover a proportion of the artefacts during topsoil removal. The soil was removed in 2 x 2 m squares – in most cases in 10-cm spits to facilitate the use of a metal detector. 35% of the ploughsoil – or c. 95 cu m – was sieved. No bone or other material of uncertain or post-medieval date was collected from the ploughsoil. In spite of this, more than 1,400 unit finds were recovered from the ploughsoil covering the MRE area, including, for instance, slightly more than 2 kg of pottery.

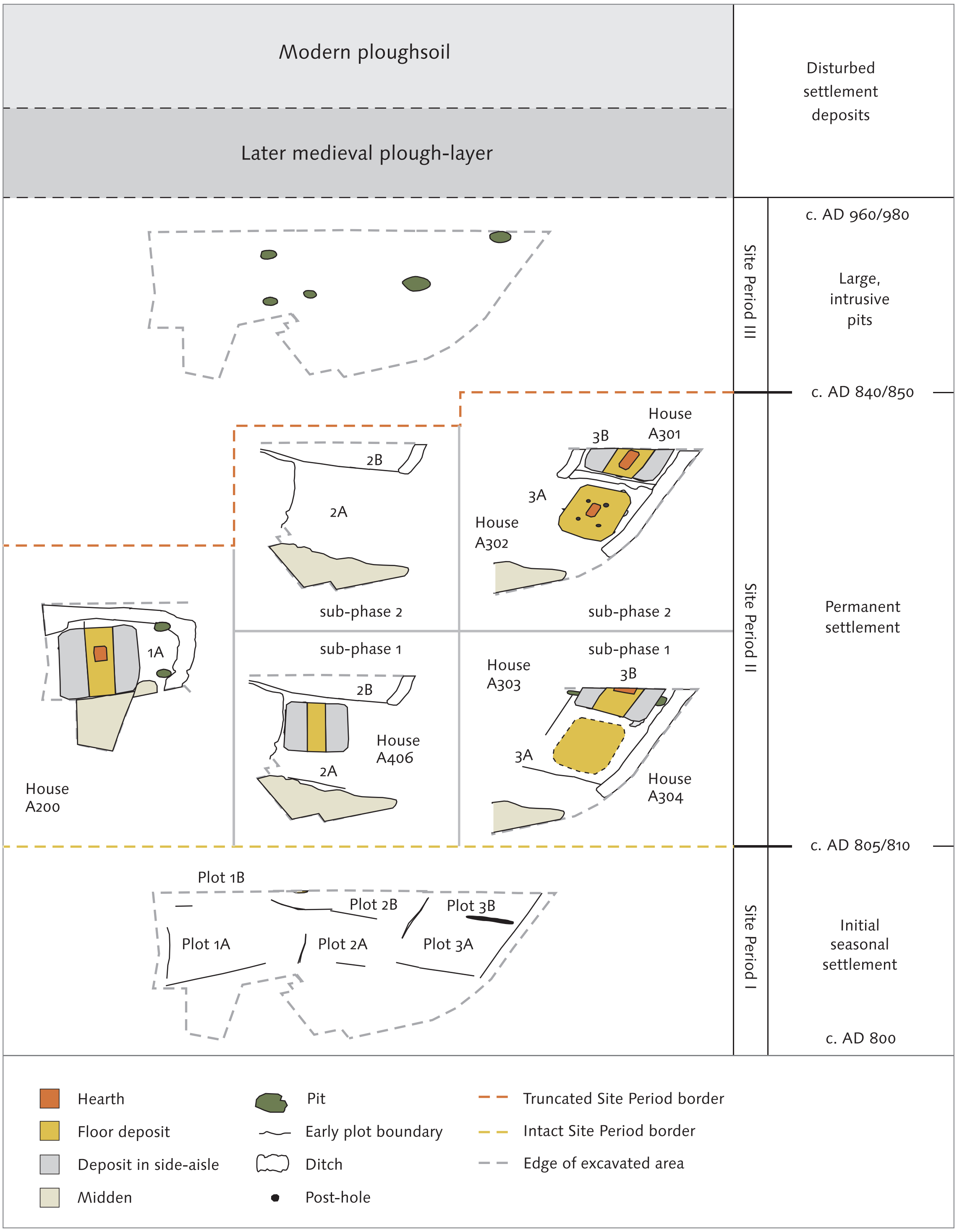
The basic tool for field documentation at Kaupang was *Intrasis* (= *Intra-site Information System*). Intrasis is an archaeological information system for recording and managing field data. Further information is available at *http://www.intrasis.com*

2.2.3 Context

The artefacts from the fieldwork at Kaupang 1998–2003 derive from both surface surveys in different parts of the settlement area and the excavation of specific sites within it. In total, more than one tonne of artefact and bone material was collected during all of the excavations and surveys 1998–2003. The proportion of broken and fragmented objects is high – as can be expected of settlement material largely consisting of discarded objects and waste. With a few exceptions, the datable artefacts belong to the Viking Age – with an emphasis on the 9th century, but continuing into the second half of the 10th.

Overall site phasing is always a difficult task in excavations with complex stratigraphy and even more so in excavations of sites with plot-divisions. The phasing within the individual plots is facilitated by the implementation of single-context recording in the field. However, inter-plot phasing regularly proves more difficult as stratification seldom can be followed across plot boundaries. This is due to the constant re-digging of ditches, renewal of fences, trampling, and other activities that took place in the divisions between the plots. This was also the case at Kaupang, and inter-plot phasing was thus impossible. Even so it can be seen that the same sequences are represented on most of the six excavated plots in the MRE – a development from a seasonal (Site Period [SP] I) to a permanent settlement (SP II and probably much of SP III), and a later truncation of the stratified deposits by ploughing, resulting in the formation of ploughsoil. Here and there a later medieval plough layer was preserved beneath the modern ploughsoil (Fig. 2.6).

Six plots were excavated from top to bottom (1A, 1B, 2A, 2B, 3A, 3B – only the A-plots were excavated in their entirety; Fig. 2.5). In general it can be said that the deposits were best preserved on Plot 3B and least well preserved on Plot 1A, i.e. that the deposits



were at their deepest (up to 25 cm) in the northern part of the excavation area and absent or nearly absent in the southern part. This is a direct consequence of a combination of ploughing and local topography. The northern part of the excavation area is at the lower end of a slope; hence, eroded soil from further up the slope washed into this area. This is also where the later medieval plough layer was at its deepest (c. 15 cm). Modern ploughing has removed the later medieval plough layer and most of the stratified deposits in the south.

Most deposits have been intensively bioturbated, which has probably led to a vertical displacement of some small artefacts (< 5 mm) such as beads and small pieces of bone. Thus single artefacts of small size cannot be used as dating evidence. In addition, the difficulty of discerning features in the deposits may have caused some small intrusive pits, post-holes or other features to be overlooked during the excavation process. As a consequence, later material may have been assigned to an earlier level than it should have been. Large intrusive features would

Figure 2.6 *A schematic overview in perspective of the Site Periods of the MRE (see Pedersen and Pilø 2007 for details). The date range of the preserved deposits from Site Period III (fill in pits) is c. AD 840/850–900. Illustration, Lars Pilø.*

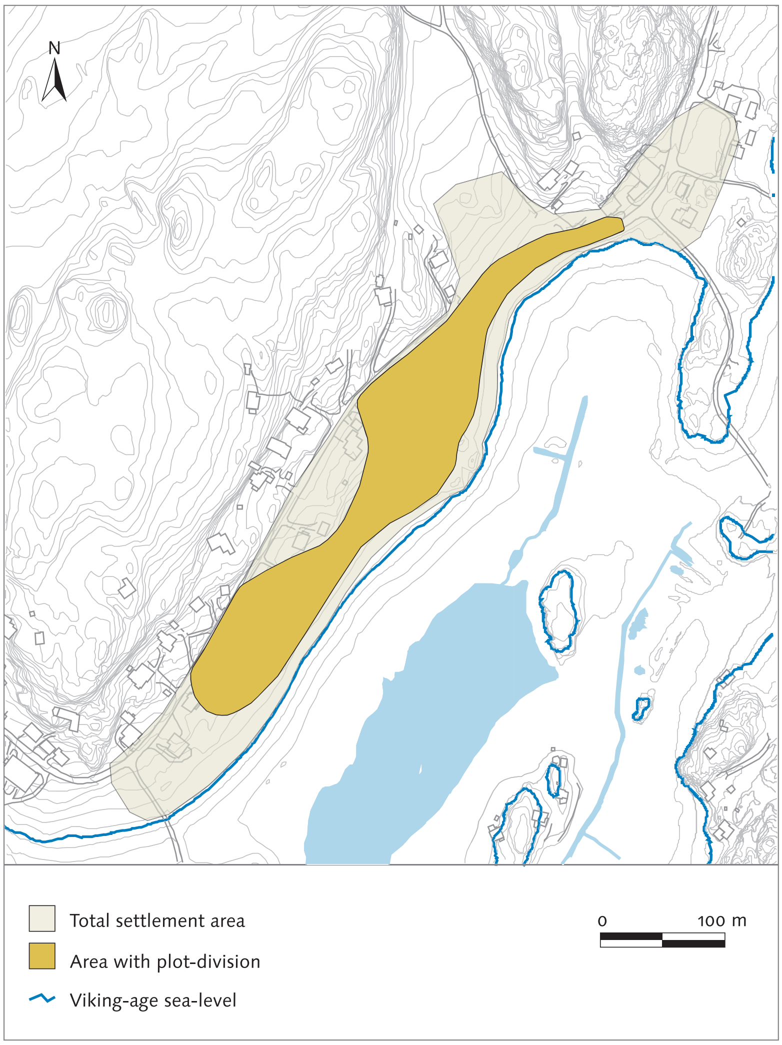


Figure 2.7 *Estimate of the Viking-age settlement area at Kaupang based on all available information. The total settlement area measures some 54,000 sq m. Contour interval 1 metre. Map, Julie K. Øhre Askjem.*

most likely have been visible in the naturally deposited beach sand below the archaeological deposits as the intact archaeological strata seldom exceeded 15–20 cm in depth. Few such undetected intrusive features were recorded, only a few small post-holes. Thus the problem of undetected intrusive features is probably very limited.

The dating range of the stratified deposits is c. AD 800–840/850 for SP I–II and 840/850–900 for the intrusive pits in SP III. Judging from the artefactual evidence retrieved from the ploughsoil, SP III has originally extended up to 960/980. (For a more detailed presentation of site periods and artefact context, see Pedersen and Pilø 2007.)

Site Period I, which comprises the earliest, seasonal part of the settlement, appears to have been quite short-lived, probably less than 10 years, from around AD 800 until AD 805/810. It is very likely that the plots were laid out simultaneously, and therefore that the start date of this Site Period is the same on each individual plot. However, the length of this initial Site Period may vary from plot to plot, as some plots may have seen earlier permanent occupation than others. The main artefact-carrying deposits from this period are a number of outdoor occupation deposits. There was no settlement on the beach prior to the establishment of the seasonal settlement, and the artefactual material should be chronologically "clean", with the few exceptions stated above.

Site Period II contains deposits from the earlier part of the permanent settlement. The upper parts of the deposits from this period were truncated by ploughing. Based on dendrochronological evidence from intrusive pits from SP III, the preserved deposits should be dated from c. AD 805/810 to c. AD 840/850. The deposits from SP II are very varied, and include occupation deposits in houses, midden layers, levelling layers, hearths, pits and ditches. SP II can be divided into sub-phases 1 and 2 (SP II:1 and SP II:2) on Plots 3A and 3B, as these plots contained evidence of consecutive buildings. The same subdivision has been made on Plot 2A, where a building erected in sub-phase 1 was demolished in sub-phase 2, when the plot was left open. SP II on Plot 2B could also be divided into two sub-phases, but only an animal shed was found there. There has been too much damage by ploughing on Plots 1A and 1B to support any division into sub-phases there, even though the presence of intrusive post-holes suggests that consecutive buildings were erected there as well. The digging of large pits began in SP II and it is thus likely that at least some residual material is present amongst the artefacts attributed to this period, especially in secondary deposits.

As mentioned above, the deposits from SP II were truncated by later ploughing, and therefore the later settlement activity at Kaupang is assigned as a whole to *Site Period III.* Thus the transition from SP II to SP III is created by post-depositional processes, not by a functional change as was the case in the transition from SP I to SP II. The transition from SP II to SP III is not contemporaneous within and between plots, because of the different degree of plough damage to the deposits on the different plots. Except for intrusive pits and deposits in the harbour, there are very few preserved deposits from SP III. The stratified material from this period derives mostly from the secondary fill of pits, which also suggests that at least some of the material attributed to this period is residual. Only a few of the pits can be dated dendrochronologically. The latest date is from a loose piece of wood in the backfill of pit A9422 dated to AD 863. No artefactual finds contradict that this may be the end date of the deposits in these pits, but as the number of artefact recoveries from the pits is very limited, the fills in some of the pits may be later than this date. Based on the lack of 10th-century finds in the pits, AD 900 is assumed to be the latest date possible for the pit fills. Looking at the evidence from the cemeteries and the harbour, it seems likely that the permanent settlement at Kaupang continued into the first three or four decades of the 10th century. The artefactual evidence from the settlement area, i.e. coins and glass beads, even indicates some activity at Kaupang as late as AD 960/980. However, the character of this final period, whether the activities were permanent or only seasonal, remains indeterminate.

The stratified deposits were covered by two plough layers. A *later medieval plough layer* covered part of the excavation area. Associated with this layer was a post-Viking-age road. The later medieval plough layer contained artefacts from disturbed Viking-age deposits and some with a late-medieval date. The *modern ploughsoil* covered all of the excavation area. The two plough layers, even though they were both disturbed, were separated during phasing. It was assumed that the displacement of artefacts was less pronounced in the later medieval plough layer than in the modern ploughsoil, and that the later medieval plough layer is devoid of modern material. The artefactual material in the later medieval plough layer is a mixture of artefacts from different contexts – from disturbed deposits from SP I to SP III, and from the later medieval farming activities. The number of post-Viking-age artefacts is very limited, and most artefacts associated with the later medieval plough layer (with the exception of iron slag) may be said with confidence to belong to the Viking-age settlement.

2.3 Main results 1998–2003

The town seems definitely to have been *founded* in the sense that the whole or most of the urban area was in one act divided into plots. There are no traces of activity prior to the division of the site into plots, as one would expect if new areas were divided into plots in the course of phases of urban expansion (Pilø 2007c). The founder must have been the Danish king who ruled in Viken in this period. Around the area with plot-division, which covers c. 20,000 sq m, there is a zone with finds of a Viking-age date but without traces of permanent construction. This zone, which covers c. 34,000 sq m, is probably where temporary visitors stayed in tents or other temporary shelters (Fig. 2.7).

That Kaupang was home to a permanent population from some time early in SP II onwards is revealed by the building-types, the quantity and the types of finds representing household activities, and finds of the bones of birds that were caught and timber that was cut in the winter months. The swift transition from seasonal to permanent occupation on the plots excavated indicates that permanent settlement was intended from the inception of the division into plots. More precise information on the duration of this process is available from only some of the plots in the main research excavation area. However the finds from fieldwalking reveal no clear chronological differences in the commencement of occupation in different sectors of the settlement area – nor in its end either. Both early and late finds are ubiquitous. At the same time, there seem to be no marked distinctions of activity zones in various parts of the settlement.

Information on building-types is available only down to the mid-9th century. However the types and quantities of finds, sediments in the harbour, and the persistence of burial, indicate that occupation and activity actually increased after that phase, and continued until c. 930 (Skre 2008b:209 note 21). But the burials and settlement finds from that date down to the cessation of activity around 960–80 are too few to provide a picture of the extent and character of settlement and business in this final phase.

Part I:

Jewellery and Ornamentation

Scandinavian Metalwork

3

BIRGITTA HÅRDH

This chapter deals with the jewellery and mounts of Scandinavian character that were found in the settlement area of Kaupang in the period 1998–2003. Twenty-six of these are of copper alloy and 28 of silver. Some of them were unearthed during the excavations and others as a result of metal-detecting. The aim of this study is to place these objects in their correct chronological contexts and, through detailed analyses, to try to reconstruct the network of contacts represented at Kaupang. The majority of the items are fragments, and the copper-alloy pieces in particular are usually severely corroded. This means that their details are often very obscure.

Finds from settlement layers complement the finds from burials in a valuable way. The latter have, up to now, been the primary basis for chronological and distributional studies of Viking-period jewellery. The grave finds constitute a deliberate selection of material, and their distribution is affected by regionality in burial tradition. The finds from settlements offer a different view of the use of metal in pre- and protohistoric contexts. A significant proportion of the objects found in such contexts can be linked directly to metalworking, and not least the recycling of old items. This means that the finds from settlements are often quite different from what appears in graves in the same vicinity. At Kaupang, some interesting differences are evident in the finds from the settlement compared with what emerged from the graves around the site.

The cast jewellery of the Viking Period consists, as a rule, of types that are common over much of Scandinavia. They can bear witness to intense and far-reaching contacts. The material from Kaupang fits this general picture well, as parallels can be demonstrated in finds not only from Norway, but also in both eastern and southern Scandinavia.

In chronological terms, the finds discussed here fit comfortably into the picture of the foundation of the site, and intense activity and permanent settlement in the 9th century, followed by a reduction in the quantity of finds from the settlement in the 10th century – with final abandonment sometime after the middle of that century. The richest and most varied assemblage consisting, inter alia, of equal-armed brooches and mounts, the pieces decorated in early Viking-period styles, provide evidence of lively activity, probably including the manufacture of these types of object from early in the 9th century. A significant proportion of the material clearly belongs to the decades immediately before and after the year 900, although it is not possible to determine how long this may have continued. The latest datable objects are certain mounts that belong to the middle of the 10th century. Two of these have parallels in England and Iceland, and so reveal a connexion with the North Sea region, a feature that is also apparent in the later graves at Kaupang.

This chapter considers the jewellery, fragments of jewellery, and decorated mounts of Scandinavian character that have been found during the surveying and excavations in the settlement area of Kaupang in the period 1998–2003. The collection amounts to 26 objects of copper alloy and 28 of silver (Tab. 3.1). All of the silver pieces except one are fragments, meaning that they can be regarded as hacksilver. These are also discussed in a separate chapter on the silver from Kaupang.

The finds are catalogued in the archives of the Kaupang Project, where information on the material, size and weight of the individual objects is recorded together with their condition, whether they

Types / Contexts	Settlement, Skre 1998–2003	Settlement, Blindheim 1956–1984	Graves	Sum
Brooches	15 (16)	7	16	38 (39)
– with rhomboidal foot	1			1
– equal-armed	6 (7)	5	7	18 (19)
– trefoil	2	2	7	11
– disc	5		2	7
– others	1			1
Pendants	2			2
Brooches or Pendants	2			2
Arm- or Neckrings	27			27
Pins	2			2
Mounts	5			5
Oval (Tortoise) brooches	0	2	39	41
Sum	53 (54)	9	39	117 (118)

Table 3.1 *The distribution of the various types of jewellery and mount in the settlement layers of Kaupang and the graves (figures for Charlotte Blindheim's excavations and the graves according to Blindheim et al. 1999).*

are whole or fragmented, and if they are corroded or not. Preliminary identifications of the finds are also given. I have reviewed the register and all of the finds to pick out those items that were probably made in Scandinavia and which can be classified by type and/or dated. However a large proportion of the material, as is commonly the case with settlement finds, consists of unidentifiable metal fragments.

The objects in question are therefore of types which are generally regarded as Scandinavian in origin. As a rule, they have parallels in various parts of Scandinavia, while in several cases we know of moulds for such items. The aim of this study is to locate these objects in their proper chronological place and to attempt to trace the network of contacts from Kaupang by detailed analyses. Objects of copper alloy from Kaupang are unfortunately nearly always severely corroded, so that they are usually very difficult to identify. The majority of the pieces of jewellery have also been fragmented, which is a further obstacle to identification.

One question of key significance is that of the level of jewellery production at Kaupang itself. The high degree of fragmentation amongst the jewellery is in close agreement with what we find in the activity layers at other Viking-period settlement sites. One may suspect that this material was for the most part intended for melting down. Scrap metal is an important component of what is found at trading and workshop sites, especially from the Late Scandinavian Iron Age. The re-use of old, broken or otherwise no longer wanted objects is a phenomenon that manifestly must be linked to a poor supply of freshly produced metal. The occurrence of recycled metal poses a number of critical problems. Objects may, as a result, have circulated either in their entire state or fragmented over wide areas and for a long time.

The dating of the finds is, of course, an exceptionally important issue. The earliest dendrochronological dates indicate that Kaupang was founded around the year 800. The site then took on an urban character with permanent settlement involving workshops and trade. From around the year 900 the finds become markedly sparser. Around the middle of the 10th century Kaupang was abandoned (Pilø and Skre, this vol. Ch. 2:25-6).

In the following, the brooches are described first, then the pendants, armring- and neckring-fragments, pins, and the mounts. Questions of dating are then discussed separately, specifically in the light of the phasing of the site outlined just above. The provenance of the pieces and what they add to our understanding of the network of contacts from Kaupang, and issues concerned with fragmentation and the recycling of metal, are discussed after that.

3.1 Dating Viking-period objects

The chronology of the Viking Period has been the subject of thorough discussion. Many suggestions have been aired concerning the dating of the period and its phasing. This section offers an overview based upon the typology and chronology that will be used for the identification and dating of the Kaupang finds.

Iben Skibsted Klæsøe (1999:90–1) has collated twelve distinct phasings of the period produced by ten different scholars (Fig. 3.1). Their chronologies were based upon links with historical information, stylistic details, combinations of finds, and more recently dendrochronological data. The Viking Period has traditionally been assigned to the years AD 800–1050. These chronological boundaries are derived from historical models using written sources. Dendrochronological datings from sites such as Ribe, Birka and Staraja Ladoga show that settlement at these sites began in the 8th century. This means that we now sometimes make use of the concept of "the *archaeological* Viking period" (e.g. Jansson 1985:186). Both scientific and numismatic evidence that are largely independent of the traditional chronology show that the archaeological Viking Period probably began as early as the beginning of the 8th century (Jansson 1985:177–81 and 186). The debates, which have focussed primarily on the dating of the beginning and the end of the Viking Period, have been reviewed by, amongst others, Thunmark-Nylén (1991, 1995), Myhre (1998) and most recently Maixner (2005). All of these scholars have argued for an early start to the Viking Period. In various publications from the first half of the 1990s this was put at 700, 750 or c. 800 (Myhre 1998:5 and refs.). The various suggestions are largely dependent upon how evidence for the production of characteristic Viking-period artefact-types such as Berdal brooches relates to dated stratigraphical sequences (Bencard 1990:225–8; Frandsen and Jensen 1990:228–31). More recent studies have proposed 750/775 or 750/800 for the start of the Viking Period (Skibsted Klæsøe 1999:90–1 and 125–6; Maixner 2005:3). On the basis of the investigations at Birka, Björn Ambrosiani (2002:340) has pointed out that numerous phenomena, including urbanization, new burial practices, and the mass production of copper-alloy jewellery, which have long been associated with the material culture of the Viking Period, seem to have become common by the final decades of the 8th century.

Amongst the attempts to divide the Viking Period internally into phases, several scholars working on cast jewellery have used the three-phase chronological scheme devised by Jansson (1985, 1991): the Early Viking Period (Early Birka Period), Middle Viking Period (Later Birka Period) and Late Viking Period. This relative-chronological system is based upon the associations of finds in closed grave contexts at Birka. In the case of the first two phases, the divisions are based upon grave groups involving the most common types of oval brooch. Using these grave-assemblages, Jansson constructed a detailed relative chronology. He picks out three clusters of primary chronological importance: types of the Vendel Period and transitional phase, Early Birka-period types and Later Birka-period types. The Early Birka-period types consist primarily of Petersen's types P37 and P27: the Berdal brooch-types with gripping beasts and the so-called Birka type. The Later Birka-period types are represented by P51, P42 and P52/55 as leading types. These occur in considerably more combinations than the Early Birka-period types do, implying that a finer sub-division of the Later Birka Period should be possible. Jansson divides it into five sub-phases (1985:124–33 and 174, 1991:268).

Absolute chronology is rendered problematic by the phenomenon of serial reproduction of the brooches, with earlier brooches often being copied in a process of reproduction that may continue long after new variants had been introduced. There are regional chronological differences between areas of Scandinavia. Nevertheless different types and variants do appear to have been most common at specific times, which may permit a further chronological phasing of the evidence (Jansson 1985:174–5, 1991:268).

In order to establish an absolute chronology, Jansson based himself primarily upon the combinations in graves at Birka that also contained coins. It is important in this case to show that large complexes of finds can be used as grouped finds and that both the presence and the absence of, for instance, certain types of coin can provide chronological evidence. As noted above, Jansson put the beginning of the Birka Period, otherwise the "archaeological" Viking Period, in the 8th century. The transition from the Early Birka Period to the Later must have taken place sometime in the second half of the 9th century, before the great influx of Samanid dirhams struck after AD 892 started to dominate the coinage in circulation on Björkö (Jansson 1985:182, 1991:268). The end of the Later Birka Period, *alias* the Middle Viking Period (MVP), is inferred to have fallen before the year 1000. For the sub-phases of this sub-period, Jansson provides a number of fixed points. MVP3 is apparently to be assigned to the first half of the 10th century while MVP5 seems to have begun around the year 980 (Jansson 1991:269–70). Jansson's scheme is used by many scholars, including Maixner (2005).

Skibsted Klæsøe has revised the Viking Period chronology (1999). Her conclusions are based upon finds from the whole of Scandinavia. Combinations of stylistic and metric data have been treated as significant, and Skibsted Klæsøe has both developed new typologies for many of the most important types of jewellery and incorporated information from Continental finds (1999:93). She proposes a division into three sub-periods, of which the middle one, Period 2, is divided into three sub-phases. Her conclusions are summarized in a general table with illustrations of key leading types located in relation to chronological boundaries proposed. Like Jansson, Skibsted Klæsøe thus divides the Viking Period into three principal phases, of which the phase in the middle can also be sub-divided into shorter spans. In respect of absolute chronology, the dates of Jansson's and Skibsted Klæsøe's phases differ in that

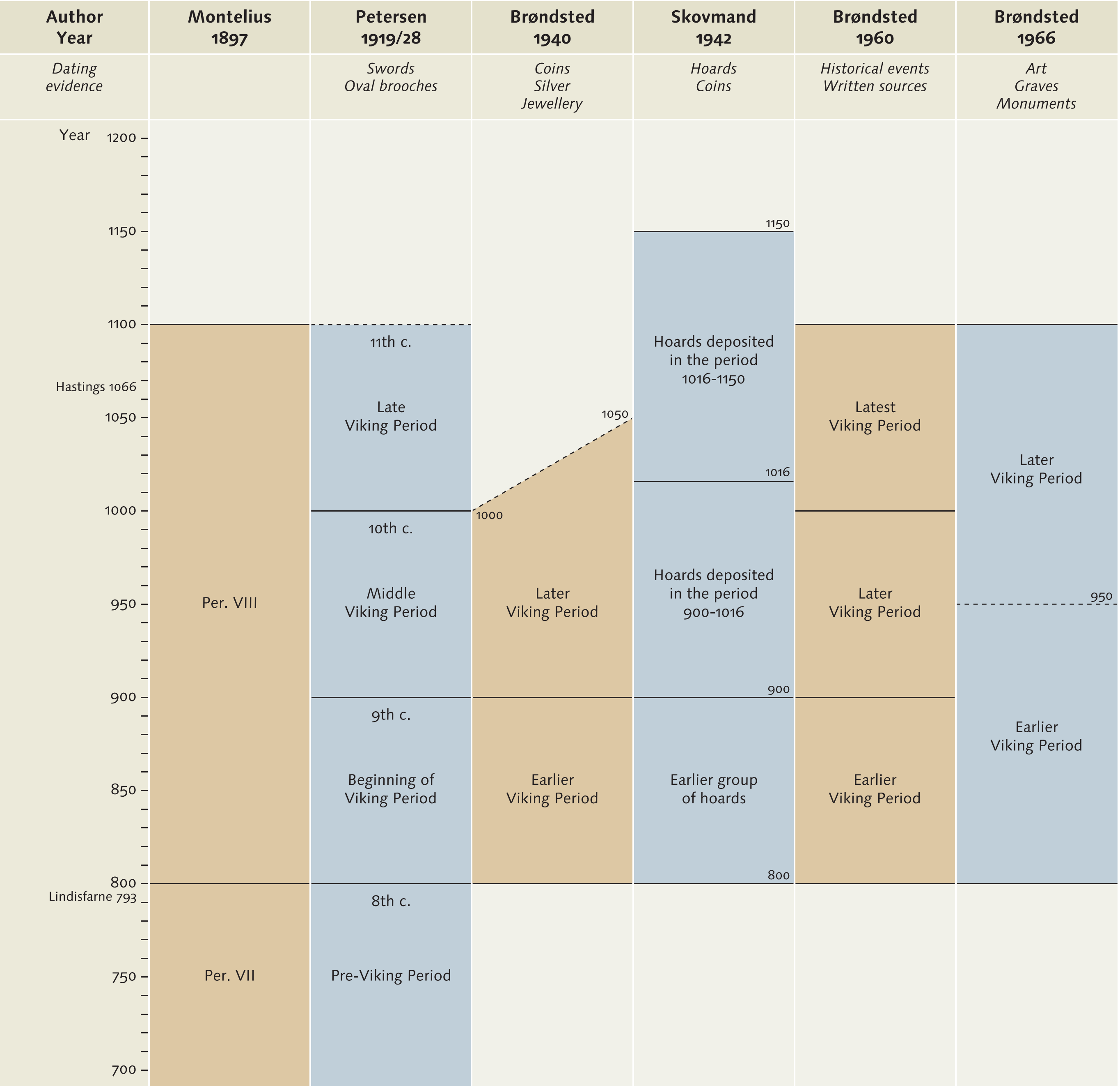
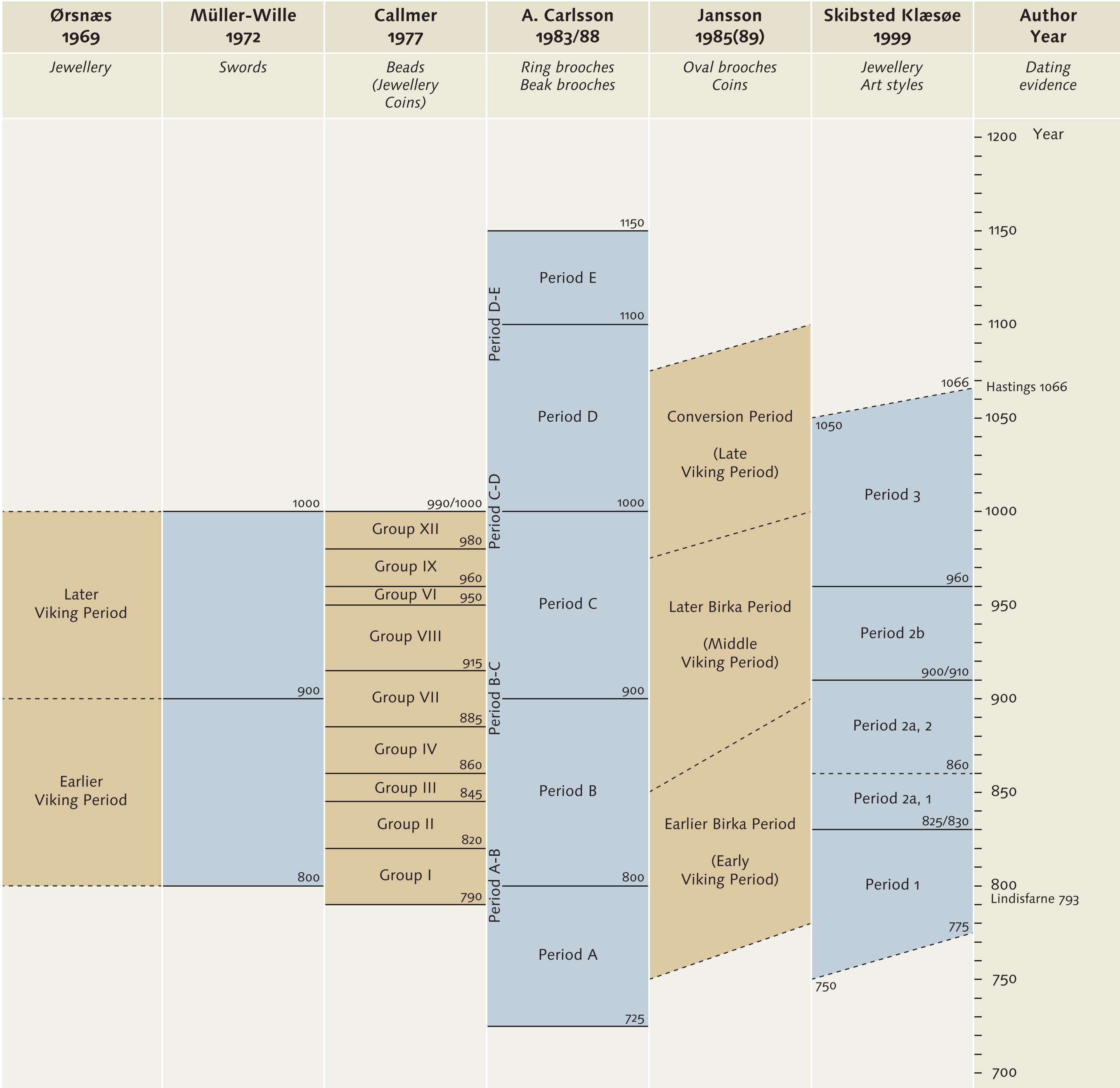


Figure 3.1 *Synopsis of chronological schemes for the Viking Period. Translation, John Hines. Drawing, Jørgen Sparre after Skibsted Klæsøe 1999:fig. 1.*

the latter's are dated earlier than Jansson's. Skibsted Klæsøe, for instance, assigns her Period 2 to 825/830–960 (1999:90–1). One problem with Skibsted Klæsøe's scheme is that it is only summarily presented and the arguments behind the various premisses are difficult to evaluate. This is probably the reason why her scheme has not yet come to be used extensively by other scholars (Maixner 2005:4). It is, however, of great significance that Skibsted Klæsøe has made use of the evidence that has been produced by metal-detecting. This is important for our view of the distribution of various types of jewellery, which in some cases differs from what was previously evident (see further below).

The chronology of the Viking Period has thus to



a large extent been based upon stylistic studies. The dating of the Viking-period art-styles has been discussed by many specialists, and the dates proposed for the various styles show considerable variation. There is a consensus on their relative order, and over the fact that they collectively represent the Viking Period. The disagreement is over the duration of the various styles and over how far they may have overlapped. The different views have been summarized by, amongst others, Jansson (1991:273) and Müller-Wille (2001:244–5; Fig. 3.2).

Both Jansson and Müller-Wille compare the range of views on the chronology of art-styles with the dendrochronological datings that provide secure reference points. It is important in this respect to remember that some dendrochronological datings provide a *terminus ante quem* (t.a.q.) for the production of the object and others a *terminus post quem* (t.p.q.) for its deposition. The datings that we have from burial structures appear, as a rule, to give us a date for the burial itself, and thus provide us with a t.a.q. for the manufacture of the grave goods. Conversely, the dating of the construction of, for instance, Trelleborg gives us a t.p.q. of 980/1 for the artefacts that are found there (Jansson 1991:271–2). It is of particular importance that the dendrochronological datings generally fall inside the date-ranges proposed for the various animal styles. However they tell us nothing about the beginnings, ends or peaks of the various styles (Müller-Wille 2001:245–6).

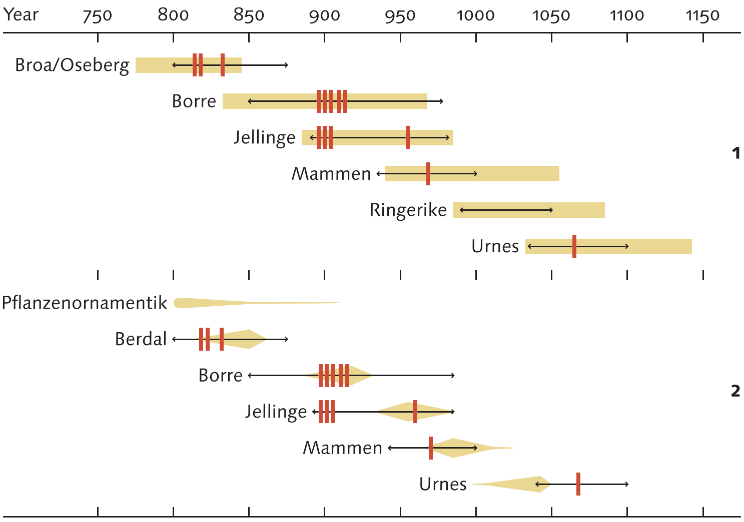


Figure 3.2 *The conclusions of different scholars on the dating of the various Viking art styles: 1. Graham-Campbell 1980, 2. Capelle 1981. The areas shaded grey show the periods to which either Graham-Campbell or Capelle assigns the various styles. Capelle has also shown when he judges the various styles to have been most common by changing the density of the shading. Fuglesang's and Wilson's views of the chronology of the various styles are represented by narrow horizontal lines. The black vertical lines present the dendrochronological datings of the various styles. Drawing, Jørgen Sparre after Müller-Wille 2001:Abb. 23.*

Müller-Wille discusses ten dendrochronological datings from Scandinavia and northern Germany that are significant as reference points for the absolute dating of individual art-styles. The datings of the Oseberg ship-burial are of great importance in the dating of the early Gripping Beast Style of the Viking Period. The dendrochronological datings show that the timber used in the burial chamber was felled in AD 834. A sword-hilt decorated in a combination of Style III and the Gripping Beast Style from Rostock-Dierkow, Mecklenburg-Vorpommern, was found in a well, the datings of which indicate that the sword cannot have been deposited there before 817 (Müller-Wille 2001:218–25). In his book *Vikingatidens konst* (1995), David Wilson provides detailed and richly illustrated descriptions of the various styles. He too discusses their dating, on the basis of associated finds. He concludes that it seems likely that Style E, and with it the gripping-beast motif, appeared towards the end of the 8th century, and may have continued to be used into the third quarter of the 9th century (Wilson 1995:58, 2001:142).

The Borre Style is usually assigned to the period around 900 with various periods of use proposed before and after that date. According to Wilson, the Borre Style can best be defined from the bridle-mounts in the Borre find itself. The core element is, in that case, a symmetrical plait pattern with every crossing point surrounded by overlapping rings covered by rhombuses: the so-called "ring chain". The ring chains can be combined with animal masks (Wilson 1995:89, 2001:145). The Borre Style is generally regarded as being based upon the traditions of the Gripping Beast Style with a modified gripping beast as its key element. With reference to the distribution of objects decorated in this style, Wilson believes that Birka, where moulds for Borre-style jewellery have been found, may have been the main centre for the production of objects in the Borre Style (1995:92). In dating the style, Wilson relies primarily upon coin-dated hoards. He concludes that the Borre Style was current for over a century, beginning around AD 850 (1995:109–10, 2001:150).

Jansson also used the oval brooches of the Viking Period, primarily those from the graves at Birka, to date the period's art-styles. In his scheme, the Borre Style appears in Scandinavia during the MVP. On Björkö it is not common until MVP3, which in his chronology is linked to the influx of Samanid coin to Scandinavia, implying some time within the first half of the 10th century. However contexts containing oval brooches indicate that the Borre Style may have emerged earlier in Norway (Jansson 1991:269).

Skibsted Klæsøe argued that with the inclusion of Continental comparanda, it is possible to use art history as a basis for chronological reasoning (1999:93). The Borre Style, which she calls "symmetrical animal style", was long-lived, in her view, from possibly as early as the 830s to immediately after the middle of the 10th century.

The graves at Borre themselves have yielded no dendrochronological dates, but Borre-style motifs are known from the ship-grave at Tune in Østfold. The burial here must have taken place around the year 900. Müller-Wille cites five dates from different find-contexts which fall around 900 and in the earliest decades of the 10th century (2001:227–31 and 244–5).

The Jelling Style has also been assigned to either longer or shorter periods by different studies. Wilson believes it to overlap with the Borre Style but also to outlive it. It must have been developed towards the end of the 9th century and was certainly still in use as late as the third quarter of the 10th (Wilson 2001:229–34). A tongue-shaped brooch decorated in the Jelling Style has been found in a grave in Jämtland associated with an Anglo-Saxon coin struck c. 991–7 (Jansson 1991:270).

Dendrochronological datings are a welcome supplement to the debate over the chronology of the Viking Period. Unfortunately, though, they are as yet few, while, most importantly of all, they provide fixed points for the datings of various styles but tell us nothing about the full chronological ranges of those styles. For the most part these datings confirm the traditional chronology albeit with a tendency for the occurrences of the various styles to lie closer to one another than had previously been thought. The Mammen grave, Trelleborg and Fyrkat fall within a 22-year period (Jansson 1991:276). Jansson's interpretation of this fact is that several stylistic movements must have taken place in parallel. This means that the artists in the circle of the Jelling kings must have had a significantly wider repertoire of styles than the traditional categorization of art history implies (Jansson 1991:276).

Below, I shall present what has been proposed concerning the various types and classes of artefact that are discussed in this chapter, with the intention, ultimately, of providing an overview of the chronological distribution of the items from Kaupang.

3.2 Changes in distribution maps

Surveys and typological schemes for the jewellery, mounts etc. of the Viking Period and earlier in the Scandinavian Iron Age are based for the most part on grave finds. For the Viking Period, Norwegian burials and those at Birka play a major part. Especially in the Late Iron Age and Viking Period, funerary practice in southern Sweden and Denmark was characterized by a paucity of grave goods. This has repeatedly produced distribution maps that show artefact-types with a centre of gravity in central Scandinavia, while the south seems conspicuously lacking in finds.

During the past couple of decades, the ploughsoils at settlement sites and central places have come under intense examination, particularly with the aid of metal-detectors. It is no exaggeration to say that this method has revolutionized the study of the Iron Age in several ways (Paulsson 1999; Pedersen 2005). Some of the sites examined have proved to be very rich in metal objects, while artefact-types that were formerly found primarily in Norway and central Sweden have also been found to be frequent at these sites. This means that sites such as Uppåkra in Skåne, Tissø and Strøby on Sjælland, and Sorte Muld and several other sites on Bornholm, have become important sources of comparative material.

It is important to note that a substantial proportion of the evidence already known is from graves, and thus represents a deliberate selection of material. The material recovered using detectors is primarily from settlement sites and thus represents other aspects of Iron-age life. The material that is found at central places and settlements has, as noted above, often proved to be linked to metalworking.

The large amount of evidence that has been produced in the past few decades by detecting on central places and settlement sites in southern Scandinavia, especially in Denmark, offers exceptional scope for the study of various aspects of Iron-age society. Analysis will confirm or change previously valid distribution maps. A major but fundamentally important task will be to review the geographical and chronological patterns (Pedersen 2005:409–10). The volume of the detector-finds, often tens of thousands of objects from single sites, makes it possible to study variation within a huge number of specimens of one type or group, and, for instance, to identify products of the same mould or model even at widely separated sites (e.g. Svensson 2001:fig. 3; Pedersen 2005:fig. 4). In a way that was previously not possible, we can trace craftsmen and their techniques and practices. Brooches and the like have quite simply become mass finds offering scope for quite different forms of analysis and questions (Hårdh 1999, 2001). The volume of the material means that we can appreciate its massive potential, but until it is recorded and published in a clear form it is impossible to realize that in full (Pedersen 2005:410).

The finds from Kaupang are compared here with unpublished material from Viking-period Uppåkra and finds from Bornholm that have appeared in the past few years. I have had the opportunity to examine those at the University Museum in Lund and Bornholm Museum in Rønne. The comparisons are otherwise based upon published evidence.

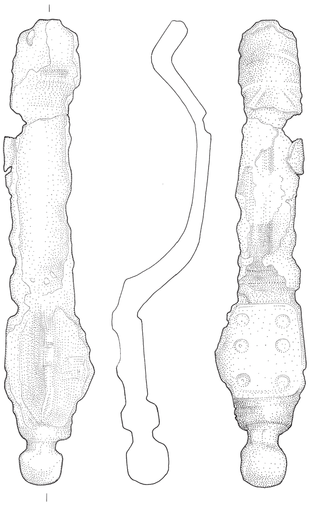
An important question to investigate in this context is in what ways the material from the graves at Kaupang is congruent with that from the stratified layers and ploughsoil in and over the settlement site.

3.3 Scandinavian jewellery and mounts from Kaupang

3.3.1 Brooch with rhomboidal foot

C52519/16453 (Fig. 3.3) is a fragment of a copper-alloy brooch, 62 mm long and 4 mm thick. The foot and bow of the brooch are preserved but the headplate, where the pin would be anchored, is absent. The bow is ribbon-shaped and convex, while the foot is rhomboidal and terminates in a "turned" knob on a short stem round in cross-section. The footplate bears the marks of six punched dots. The bow has decoration in the form of transverse lines that have almost disappeared. There is no sign of the pin-catch, which may have been filed away. This is one of the oldest objects at Kaupang, and is to be dated to the Migration Period.

The fragment finds various parallels amongst detector-finds from southern Scandinavia, includ-



ing some from Uppåkra and Bornholm. It is difficult to classify the sub-type more precisely in the absence of the headplate. It could have been a cruciform brooch. Cruciform brooches with rhomboidal footplates are relatively rare. Some examples with a round knob at the end of the rhomboidal foot have been found at Uppåkra (e.g. Hårdh 2003:fig. 1). Besides those, a few German finds of cruciform brooches with rhomboidal footplates can be cited (Schmidt 1961:Taf. 31m, 1975:Taf. 155.2; Laux 1996:335 and fig. 276).

An alternative possibility is that the rhomboidal footplate is from a crossbow brooch. This type of brooch, with the bow terminating in a loop that holds the axis of the pin-spiral and a rhomboidal footplate, occurs primarily in the Baltic zone and on Bornholm (Näsman 1984:map 12a; cf. Bitner-Wróblewska 2001). A number of examples with rhomboidal footplates have been found at Uppåkra (Hårdh 2003:fig. 4), and amongst settlement finds from Bornholm: for instance from Skovgård, Klemensker parish, and Sandegård, Aaker parish. The material from Smørende, Vestermarie parish, and Rytterbakken, Klemensker parish, includes brooch-fragments comprising a ribbon-shaped bow and rhomboidal footplate terminating in a turned knob with a plane back. The fragment from Smørenge is from a brooch that was somewhat smaller than the Kaupang example but was otherwise very similar.

The rhomboidal footplate, usually with a knob-shaped terminal, is clearly at home in the Baltic region, not least on Bornholm. However crossbow brooches with rhomboidal footplates and fragments of rhomboidal footplates are also known from the production site at Hørup, northern Sjælland, amongst finds from the Roman Iron Age and Migration Period (Sørensen 2000:figs.56–7). Näsman was of the opinion that in the Migration Period it is possible to distinguish a West Scandinavian sphere, characterized by cruciform brooches, from an eastern counterpart with crossbow brooches (1984:116). Bornholm would then belong to the eastern sphere, but the two would meet at Uppåkra, where these two brooch-types are approximately evenly represented (Hårdh 2003). On Gotland there is a peculiar form which looks more than anything like a hybrid cruciform and crossbow brooch (Nerman 1935:Taf. 8.58–61). The rhomboidal footplate on the Gotlandic brooches, with its knobs, also has clear similarities to the Kaupang fragment.

The incomplete brooch from Kaupang represents a form that evidently belongs to the Migration Period and southern Scandinavia and the Baltic zone. The question for us is how it should be interpreted in its Viking-period context. It is most probable that it represents old scrap metal ready for recycling. It would be interesting to know whether it reached Kaupang as a fragment with a consignment of raw material. It is in any event important to note that very old objects could circulate for a long time as scrap and so appear in much later contexts than we would expect. Amongst the oldest objects from Kaupang are two Roman bronze coins of the 4th century. These were probably lost at the site during the Viking Period (Blackburn 2005b, 2008).

3.3.2 Equal-armed brooches

The most numerous category of Scandinavian jewellery in the finds from the new work at Kaupang consists of the eight fragments derived from seven or eight equal-armed brooches (C52516/4095; C52517/254; C52517/2050; C52516/3880; C52517/2089: C52517/926; C52517/779; C52517/2531: Figs. 3.4–11). Equal-armed brooches are elongated and completely symmetrical, so that they can be divided across the middle, lengthways or crossways, into two identical parts. The majority of the equal-armed brooches are made up of three parts: a central part and two identical arms, one on either side of the middle (Aagard 1984:95; Callmer 1999:202–3; Skibsted Klæsøe 1999:fig. 9).

Figure 3.3 *Brooch with rhomboidal foot (C52519/16453). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

The equal-armed brooch is usually regarded as one of those that are known as the "third brooches" of Viking-period female costume. The function of this brooch may have been to fasten an over-garment in the form of a mantel or shawl (Hägg 1971:144). The term "third brooch" is derived from the sets of dress-brooches in graves, particularly at Birka. Callmer has shown that the equal-armed brooch could also be worn separately rather than in combination with oval brooches. This is shown clearly by the high frequency of this brooch-type in southern Scandinavia, including Uppåkra (Callmer 1999:201). Equal-armed brooches have been found in significant quantities on settlement sites in southern Scandinavia in recent decades. On Bornholm this is one of the most common brooch-types of the Viking Period – perhaps the most common.

It is difficult to identify direct ancestors of the Viking-period equal-armed brooches. Small equal-armed brooches are familiar from the preceding period in Scandinavia. Aagård argues that it is unlikely that the Viking-period examples have their origins in these. She looks instead to a possible connexion with equal-armed brooches on the western Continent, for instance from Domburg in Holland. Equal-armed brooches remained in use in western Europe from the 7th century to the 9th (Aagård 1984:95–6; Skibsted Klæsøe 1999:99 and refs.).

The brooches have been subclassified by several different scholars. Petersen's classification of the Norwegian brooches that were available for study in the 1920s is still widely used. Petersen wrote that in no other case did the Viking-period bronzesmiths show so much creative imagination as they did with the equal-armed brooches. He took account of 60 equal-armed brooches from Nowegian finds, assigned to a series of sub-types and variants. On the evidence of find-associations, the equal-armed brooches were principally in use in the earlier Viking Period. Petersen suggested that practically all of the Norwegian brooches belong to the 9th century (1928:76–93 and figs. 58–83). Petersen's scheme is the basis of the majority of later studies of the brooch-type, and his figure numbers are commonly used as type-designations. Terms that are widely used for various sub-types of equal-armed brooch, such as the Ljønes type, derive from Petersen's work. These terms can be misleading, as it can erroneously be assumed that the forms have their origin or are most frequent at those sites whose names the sub-types bear.

A systematic classification was undertaken by Aagård (1984) based upon the brooches in the graves at Birka. She divided the brooches into a hierarchical system involving five principal groups, I–V, and a number of sub-groups. Aagård noted that equal-armed brooches had a wide geographical distribution, but the majority of them are from eastern Sweden. They are also quite common in Småland and on Öland (Aagård 1984:96). It is clear, however, that numbers of finds have grown markedly in southern Scandinavia as a result of the investigations of workshop and central places in recent decades. Starting with the finds from Uppåkra, Callmer undertook a review with detailed consideration of a large number of variants of equal-armed brooches, their dating, and their distribution. In respect of the terminology for the variants, however, he respected Petersen's work of 1928 (Callmer 1999).

Skibsted Klæsøe has classified the equal-armed brooches into five groups, SK1–5. Her scheme is much simpler than Aagård's or Callmer's. Her type 1 is characterized by geometric decoration, type 2 by asymmetrical animal ornament (Carolingian animal art, the early Gripping Beast Style and the Berdal Style), type 3 by symmetrical animal ornament, i.e. the Borre Style, and type 4 by animals riveted on to the arms and a crown in the central field. Individualistic specimens are grouped as type 5. The purpose of this simplified typology was to facilitate chronological comparisons with, primarily, oval brooches from much of Scandinavia (Skibsted Klæsøe 1999:100–1).

The earlier excavations at Kaupang produced at least twelve equal-armed brooches (Blindheim et al. 1999:31–2). One, perhaps two, of these is of the Ljønes type, which is also the most common type at Birka. It is characterized by arms that terminate in a full-face mask (Aagård 1984:100–1). Two brooches are in the Gripping Beast Style. Four brooches, two of them silver, are identified by Heyerdahl-Larsen as Continental types. Two of them are from the settlement and two from the cemeteries. There is finally one brooch of what is known as the Valsta type. Brooches of this group have rhomboidal arms, each of which has three points, on which in turn there is on each an animal's head, face-on, with horn-like, slightly curved eyes (Callmer 1999:204). Moulds for

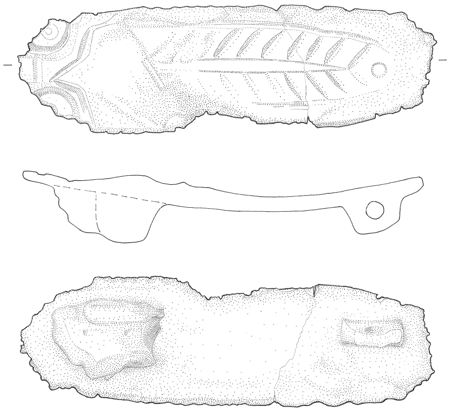


Figure 3.4 *Equal-armed brooch with hachuring (C52516/4095). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

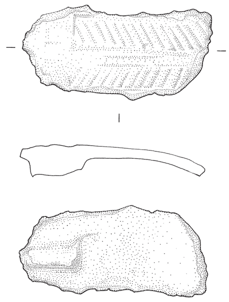


Figure 3.5 *Equal-armed brooch with hachuring (C52517/254). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

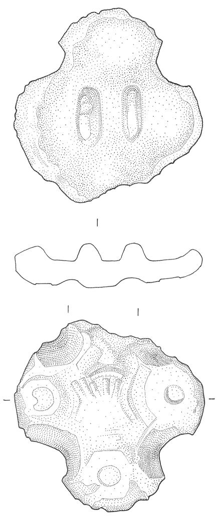


Figure 3.6 *Equal-armed brooch of Ljønes type (C52517/2050). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

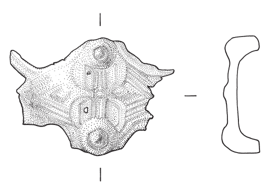


Figure 3.7 *Equal-armed brooch of Ljønes type (C52516/3880). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

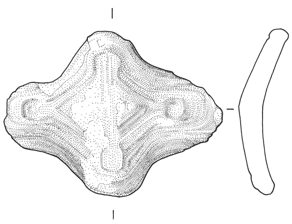


Figure 3.8 *Equal-armed brooch of Ljønes type (C52517/2089). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Valsta-type brooches have been found in the excavation of the Black Earth at Birka (Ambrosiani 1999a:118–19). Heyerdahl-Larsen argued that the equal-armed brooches from Kaupang are, as a group, highly diverse, with no clear groups. Chronologically, they belong to the Early Viking Period (Heyerdahl-Larsen 1999:31–2).

Amongst the new finds from Kaupang I have discovered eight fragments deriving from six or seven equal-armed brooches. A small quadruped animal is also probably from an equal-armed brooch, and a domed knob may also come from such an object although it is also possible that it was originally attached to an oval buckle.

The equal-armed brooches of the Viking Period have thus been analysed and classified by several different scholars. The fragments from the most recent work at Kaupang are classified as far as possible with reference to the schemes of Petersen (1928), Aagård (1984), Callmer (1999) and Skibsted Klæsøe (1999).

Two hachured brooches

C52516/4095 (Figs. 3.4, 3.12) consists of two copper-alloy fragments from an oblong brooch, together 55 mm x 17 in size and 3 mm thick. The brooch had parallel or possibly slightly outcurving sides and rounded ends. The main part of the brooch is occupied by a hachured oval field with a pointed oval in the centre. The ribbon-shaped fields between the edges of the oval and the pointed oval are filled with oblique hachuring producing a fishbone effect. This terminates at one end of the oval with a point. At the other end of the brooch there are two points, each surrounded with a circle, and a V-shaped line. Altogether this is clearly a representation of an animal's head with two eyes and eyebrows. On the rear there are the remains of a pin-catch and two rivets plus the remains of the iron pin.

C52517/254 (Figs. 3.5, 3.12) is a copper-alloy fragment of a brooch, 26 mm x 12. It is approximately half of a brooch apparently of the same type as the preceding one except that the hachured lines that form the fishbone pattern are more densely packed. This fragment is severely corroded, but the fishbone decoration is quite clear. Remains of a pin-catch are present on the back of the fragment in the form of a substantial, broken off rivet.

The best preserved of the two brooches, C52516/4095 (Fig. 3.4), can be compared with domed oval brooches of the Vendel Period which carry an animal seen from above: Ørsnes types N and O. These are characterized by eye-motifs at one end and a divided back filled with hachures (Ørsnes 1966:figs. 172–4 and 190). Types N and O belong to Ørsnes's phase 3, late in the Danish Late Germanic Iron Age/Vendel Period (Ørsnes 1966:224; Jørgensen 1994:Abb. 124:17 and 19). The Kaupang brooches, however, are flat, and thus cannot be paralleled exactly with these moulded brooches. The similar decoration, on the other hand, may indicate that they were the source of the design. From Uppåkra there are two brooches that are also close to the Kaupang brooches, particularly because of the form and decoration of oblique lines, albeit with no animal's head (Callmer 1999:215 and fig. 25). This type of brooch is also represented at Tissø on Sjælland (Jørgensen and Pedersen 1996: fig. 18). Callmer points out that this type may be associated with rectangular brooches on the Continent, which would also have implications for its dating, which Callmer, with reservations, considers to be late 8th century. The distribution of the brooches seems to indicate that the type is Scandinavian (Callmer 1999:215). This conclusion is supported by more recent finds in southern Scandinavia, for instance from Bornholm and a couple of examples from Uppåkra, that have been made since Callmer's survey. One of these, U10457, displays marked similarities to the Kaupang brooches, especially C52516/4095 (Fig. 3.4). The Uppåkra specimen also has a double pin-catch and similar decoration, although it lacks the two eyes.

A third possibility is that the brooch is the centre of a tongue-shaped buckle. Petersen illustrated such an object and proposed that the fishbone pattern was simplified leaf-decoration (1928:125–6 and fig. 133). There is a similar buckle, albeit with different decoration, from Birka (Arbman 1940:Taf. 85.3). The centre of the buckle illustrated by Petersen, like that from Birka, is clearly moulded, while the Kaupang piece, like the Early Viking-period brooches from southern Scandinavia, is flat.

It is perhaps appropriate to regard the two brooches from Kaupang as local variants of southern Scandinavian forms. The animal motif on these two brooches makes the link with Vendel-period brooches of southern Scandinavia most convincing. It is possible that the Kaupang brooches are a local development from those and in such case they should be dated to the transition from that period to the Viking Period or to the very beginning of the Viking Period. A point of interest in this context is the fact that there is a small group of equal-armed brooches from western Norway with an animal head at both ends. These, apparently a local variant type, bear a certain similarity to the brooch-types discussed here. The brooches from western Norway have been linked to the animal-shaped brooches of the Norwegian Merovingian/Vendel Period. In Callmer's view, this local production builds upon traditions inherited from the Vendel Period, but with the capacity to incorporate new elements (Callmer 1984a:71–2 and 74).

Two (three) fragments of Ljønes brooches

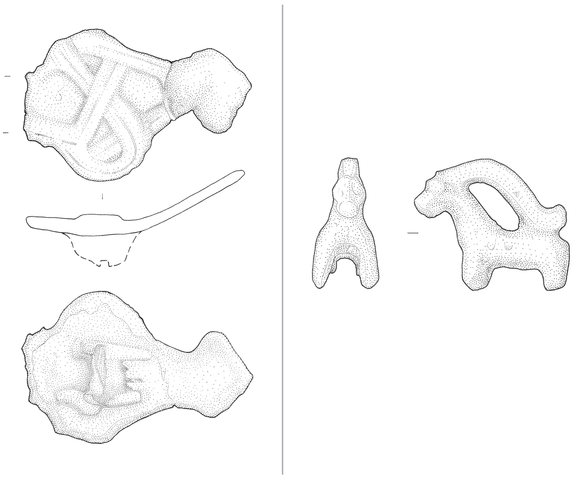
C52517/2050 (Figs. 3.6, 3.12). This almost trefoil-shaped fragment is one terminal of a brooch of the Ljønes type (Petersen 1928:76–7 and fig. 58). According to Aagård's classification it belongs to Group IA:1 (1984:100). The front is corroded but decoration comprising a round pit in each arm, frames along the sides and traces of plaitwork in the centre show that it is one of that group. The object is made of copper alloy and measures 26 mm x 25. The back is rounded in cross-section with marked edges. Only traces of the pin-anchor in the form of two rivets remain. This seems to have been filed off. The decayed state of the fragment makes further classification difficult, but the rounded profiles of the projections mean that it should probably be assigned to what is known as the earlier Ljønes series which, by Callmer's scheme, has more rounded projections while the counterparts of the later series have a more squared outline. According to Callmer's classification, the Sätuna variant, which is related to the earlier Ljønes series, has a bird motif on the arms (Callmer 1999:205–8). A couple of loops in the central field of the Kaupang fragment may be all that is left of such a design (cf. Callmer 1999:figs. 5 and 8). The round areas with cavities show that this brooch had loosely attached knobs, which is also a feature of the Sätuna variant. One fragment of this variant is also known from Uppåkra. This had come from a brooch of approximately the same layout as the Kaupang specimen. The Sätuna type is uncommon, and except for the example cited from Uppåkra, is represented, according to Callmer, only by one specimen from central Sweden (Callmer 1999:206).

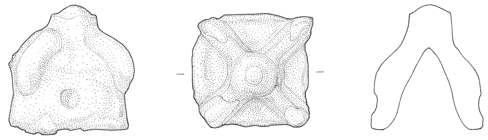
C52516/3880 (Figs. 3.7, 3.12) is a fragment, the central part of an equal-armed brooch, measuring 22 mm x 16 and 4 mm thick. The copper-alloy fragment is decorated with two round knobs connected by straight ridges. The underside is concave. This fragment is also to be attributed to Aagård's type IA.1 of the Ljønes series (Aagård 1984) or to the Valheim variant which, according to Callmer, is otherwise represented by two brooches from Rogaland (Callmer 1999:206 and fig. 5; Petersen 1928:76–8).

C52517/2089 (Figs. 3.8, 3.12) is a copper-alloy fragment measuring 29 mm x 23 which may come from a brooch, possibly an equal-armed brooch, and also perhaps of the Ljønes type. This fragment practically has the shape of a four-leafed clover, and is severely corroded. If it was part of an equal-armed brooch it would have been one of the arms. It has been cut or broken off. There is a round pit in one leaf, and the upper side reveals faint traces of linear decoration. The back is rounded in cross-section but shows no signs of a pin-anchor or pin-catch (cf. Petersen 1928:fig. 58).

Petersen defined the Ljønes group as a simple type bearing linear decoration with little variation. With its nine specimens it was the largest single group of equal-armed brooches discussed by Petersen. It was named after two brooches found in Nordland (Petersen 1928:76–8). The brooches of the Ljønes group are constructed of three similarly sized rhomboidal plates, which form the central part and the two arms. The sides of the rhombuses are slightly concave. The decoration consists of geometric plaitwork (Callmer 1999:205; Skibsted Klæsøe 1999:100). These brooches belong to the beginning of the Viking Period. Aagård cites both Petersen and Jansson, who assigned the type to the 9th century (Aagård 1984:106–7 and refs.). Skibsted Klæsøe dates the introduction of the Ljønes type to the late 8th century and proposes that it continued until the mid 9th century (1999:103 and fig. 29). Callmer regards brooches of the Sätuna type as closely related to the earlier Ljønes series, which is dated from immediately before the year 800 across the first quarter of the 9th century. The Valheim variant also belongs with the earlier Ljønes series, although perhaps a little later in the sequence (Callmer 1999:206–8).

According to Aagård, type IA:1, which she identifies with the Ljønes series, is the most common variant at Birka, where it is represented by twenty specimens. Besides Birka, Group 1 appears all over Scandinavia, but with its centre of gravity in Sweden, especially in Uppland and Småland (Aagård 1984:103–4). Fragments of moulds for the production of Ljønes-type brooches have been found at Birka and in Ribe (see further below). Of significance are the fifteen fragments of brooches of the Ljønes group found at Uppåkra. It is common on Bornholm too, for instance at the settlement sites of Sorte Muld in Ibsker parish, Smørenge and Nedre Ellebygård in Vestermarie parish, and Dyrekobbel in Pedersker parish (finds in LUHM and BMR).





A further fragment

C52517/926 (Figs. 3.9, 3.12) is a fragment of a copper-alloy equal-armed brooch measuring 20 mm x 30. It is one side of the brooch. The face displays simple plaitwork decoration of ribbons of equal width with a line running along the centre. The ribbons cross over at two points and otherwise follow the outer edge of the object. On the reverse there is a pin-anchor with two rivets and remains of the iron of the pin. This fragment is from an equal-armed brooch of the Hodneland type (Petersen 1928:fig. 59). This type of brooch has some similarities to the Valsta type which, as noted above, has itself been found in earlier excavations at Kaupang. The central zone is round, and the three free cross-ends of the arms project from the sides. This is a very rare type of brooch, known, according to Callmer, only in three other specimens, from Norway, northern Jutland and Uppåkra respectively. It is a type of the very beginning of the Viking Period which is linked to brooch-types of the western Continent (Callmer 1999:204–5).

Quadruped and knob

C52517/779 (Figs. 3.10, 3.12) is a small, chunky, modelled quadruped in copper alloy, measuring 22 mm x 18. The animal has a rounded, muscular body, and a long mane. Animals of this kind appear attached to certain types of equal-armed brooch, one on each arm. There are several examples from Birka (Arbman 1940:Taf. 82:7–9). These brooches are of Aagård's type ITB:1 (Aagård 1984:102). The quadruped animals with long manes have sometimes been identified as billy-goats. Some connexion with the

Figure 3.9 *Equal-armed brooch (C52517/926). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.10 *Modelled quadruped animal, probably from an equal-armed brooch (C52517/779). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.11 *Knob, from an equal-armed brooch (C52517/2531). (Scale 1:1.) Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.12 *Fragments of equal-armed brooches from the fieldwork at Kaupang 1998-2003. Upper row, from left: C52516/4095, C52517/2050, C52516/3880. Centre: C52517/254. Lower row, from left: C52517/2089, C52517/926, C52517/779, C52517/2531. Photo, Eirik Irgens Johnsen, KHM.*

Jelling Style, where long-maned quadrupeds are a key motif, is probable. Aagård also refers to the great beast on the Jelling stone as a conceivable parallel (1984:105). A silver modelled maned quadruped with larger and markedly more rounded contours has been found at Uppåkra. This has been associated with western European material of a Christian character and dated to the very beginning of the Viking Period (Helgesson 1999). Aagård notes that brooches of her Group IV are so strongly concentrated on Björkö and in Uppland that it is likely that they were made in this region, perhaps at Birka (Aagård 1984:106). Skibsted Klæsøe attaches significance to the fact that this type of brooch, which she calls SK type 4, is common in southern Scandinavia, including Bornholm, as well as being found in eastern Scandinavia (Skibsted Klæsøe 1999:103).

Plastic modelled quadrupeds like that from Kaupang are also found on disc brooches: for instance on a large silver specimen from Taxinge-Näsby, Södermanland (SHM 9136). The Taxinge hoard combined jewellery, hacksilver and coins with a t.p.q. of 965.

At Birka, Group IVB:1 occurs in rich assemblages, so that it can be dated with a high level of confidence. There are several examples of combination with oval brooches of type P51, and so belong later in the Viking Period: what is called the Later Birka Period in this context (Aagård 1984:108). According to Skibsted Klæsøe, it is likely that her SK type 4 was in use in the second half of the 9th century and into the 10th (1999:103 and 124). Aagård and Skibsted Klæsøe are thus largely in agreement over the date.

C52517/2531 (Figs. 3.11, 3.12) is a knob of copper alloy, measuring 16 mm x 17, with a domed upper side and a small cylindrical socket. On the convex upper side there are two ridges which cross. In the middle of the upper face, where the ridges cross,

there is a small round knob. Four smaller round knobs are placed on the ends of the ridges. This object may be from an oval brooch, but it could also have sat upon the bow of an equal-armed brooch such as examples illustrated by Petersen and Arbman (Petersen 1928:fig. 69; Arbman 1940:Tafn. 80.1 and 81:1–9). Domed knobs with cylindrical necks similar to the Kaupang piece are found on brooches of Aagård's type IVB:1. These have a riveted-on crown with milled crossing bands and a central knob over the point at which these strands cross (Aagård 1984:102). Aagård's type IVB:1 is, as already noted, characterized primarily by modelled animal muzzles representing quadrupeds like C52517/779 (Fig. 3.10). But whether the knob found at Kaupang came from a brooch of this kind or not, we simply cannot say.

Summary

The new finds from Kaupang fit well with the equal-armed brooches already known from both the graves and the settlement at this site. Both the cemeteries and the settlement had produced brooches of Aagård's type IA:1, the Ljønes type, which is now also represented by two, possibly three, fragments amongst the new finds. Aagård's Group III is represented by two specimens from the graves and one from Blindheim's excavations in the settlement. This group is distinguished, in Aagård's view, primarily by having arms terminating in full-face masks. The Valsta-type brooch from the earlier excavations in the settlement area is similar both in appearance and date to brooches of the Hodneland type (Blindheim et al. 1999:fig. 5; Callmer 1999:204). Here, then, is a definite connexion between the earlier finds from the settlement site and the more recent ones. The finds from the graves also include, as already noted, a Continental equal-armed brooch of silver. Two equal-armed brooches of Continental origin are also found amongst the newly uncovered finds (Wamers, this vol. Ch. 4:76-8). The equal-armed brooches from the excavations of 1998–2003 thus agree well with what had previously been found at Kaupang.

The majority of the brooch-fragments are of types that are dated to the period around AD 800 and the first part of the 9th century. The modelled animal, the central knob, and the model of a central knob, pertain to a later period, with the range of finds associated with oval brooches of type P 51: to the Later Birka Period (cf. Jansson 1985, 1991:268–9) or the period around AD 900 and the early 10th century.

In addition to the finds described above, there are several fragments of equal-armed brooches in lead. Although, in many cases, it is difficult to determine whether or not these are models for making brooches or finished jewellery (Pedersen, in prep.), it is highly likely that they bear witness to the production of equal-armed brooches at certain junctures in the history of Kaupang.

From Birka, we have 61 equal-armed brooches from 59 graves. They range from the Early Birka Period, or the 9th century, to the Later Birka Period, with a definite predominance in the earlier phase (Aagård 1984). A large number of moulds demonstrate that equal-armed brooches of various forms were manufactured at Birka, including brooches of what is called the Ljønes type, a widespread form over all of Scandinavia. In some cases it has been possible to link moulds directly to brooches that have been found in the graves at Birka (Arrhenius 1973:106 and fig. 44b–c; Ambrosiani and Eriksson 1992–3:37–41; Ambrosiani 1999a:119). Moulds for equal-armed brooches have also been found at Ribe (Madsen 1984:78; Jensen 1991:35).

Graves containing equal-armed brooches are not evenly distributed across southern Scandinavia,. They have a clear centre of gravity in the East, where equal-armed brooches are common in closed grave-assemblages from south-eastern Skåne, Blekinge and Bornholm (Svanberg 2003:101, 120 and 129). By contrast they do not occur in grave-assemblages around Hedeby (Hedeager Krag 1994:23 and fig. 13). In the grave-finds from south-western Skåne discussed by Svanberg there are no equal-armed brooches. On the other hand, detector-surveys of recent years have produced considerable collections of these brooches from, inter alia, Gudme on Fyn, Tissø and Strøby on Sjælland, and Uppåkra. This shows how drastically distribution maps have been changed as a result of more intensive investigations of settlement deposits (Jørgensen 1993:53; Tornbjerg 1998:229; AUD 1999:238).

Callmer discussed 30 equal-armed brooches from Uppåkra, but the corpus of finds has since risen to over forty pieces. The majority of the equal-armed brooches from Uppåkra date to the 9th century. Callmer assigns only two examples to the 10th century. This is closely in agreement with the course of development in western Scandinavia together with Skåne and Bornholm, where the equal-armed brooch is typically a 9th-century artefact-type that became less frequent in the 10th century (Callmer 1999). The new finds from Uppåkra, from the most recent years, are entirely congruent with the picture Callmer paints.

With regard to dating, Skibsted Klæsøe is of the opinion that her simplified typology offers a more reliable basis for working with comparative chronological evidence. She assigns her type 1, to which the majority of the Kaupang examples belong, to the Early Viking Period, from the end of the 8th century and beginning of the 9th. Brooches with attached animal figures probably belong to the second half of the 9th century and into the 10th (Skibsted Klæsøe

1999:103). Thus the datings given by the various scholars for the range of brooch-types are in concordance.

The newly found equal-armed brooches from Kaupang fit in well with those that had been found in earlier excavations at the site, both in the cemeteries and in the settlement area. Typologically, the corpus of finds from Kaupang also fits well with the equal-armed brooches from such geographically distant sites as Uppåkra and Birka. In terms of chronological distribution, both Kaupang and Uppåkra have an earlier major concentration, in the 9th century, than at Birka, where later types are relatively frequent.

Skibsted Klæsøe has shown that equal-armed brooches are found over much of Scandinavia but that individual types have different geographical ranges. The animal-decorated brooches of her type 2, with asymmetrical animal decoration, are found almost exclusively in Norway, while types 1, 3 and 4 are particularly found in southern and eastern Scandinavia (Skibsted Klæsøe 1999:103). This observation is of especial interest in the present context. The type with early Gripping Beast-style decoration that is supposed to be characteristic of Norway is represented only by a single specimen in the graves at Kaupang. There is not one example in the finds from the settlement site either from the earlier excavations or the recent campaigns. The newly found fragments derive from types that are widely distributed throughout Scandinavia. This is also the case with the lead fragments that may represent the manufacture of equal-armed brooches on the site (Pedersen, in prep.). This difference may be evidence of the settlement and trading site's peculiar position in relation to the surrounding area.

3.3.3 Trefoil brooches

The trefoil brooch is a common item of jewellery of the Early Viking Period. From the recent excavations at Kaupang we have two fragments, from separate trefoil brooches (C52517/1459 and C52516/4101; Figs. 3.13–14). The brooch-type derives from trefoil mounts used in the Carolingian area to connect the straps of sword-harnesses (Maixner 2005:24–5 and fig. 8). A small number of Carolingian trefoil mounts have been found in Scandinavia, including a gilt silver mount from Häljarp, Skåne, which Skibsted Klæsøe has associated with a court school that worked for Charlemagne from 780 to 800 (1995:110). The fine gold mount from Hoen, Buskerud, represents the final period of Carolingian plant ornament of the second half of the 9th century, and has parallels in the manuscript illumination of the Metz School and in manuscripts and works of art produced for Charles the Bald. This mount was remade into a brooch (Lennartsson 1999:531; Maixner 2005:27–8 and refs.; Wamers 2005:55). The hoard found at Duesminde on Lolland in 2002 comprises a large number of Carolingian mounts, including a sword-set consisting of three oval mounts, one tongue-shaped mount and a trefoil mount. All of these are of gilt cast silver, and decorated with acanthus ornament. They derive from Frankish court or monastic workshops, and are dated c. 830–870. The trefoil mount had also been re-used as a brooch (Wamers 2005:129–33). Maixner argues that even though the quantity of surviving imported Continental mounts is small, the material shows that Scandinavia was reached by a wide range of Carolingian plant ornament (2005:27).

The trefoil brooch is one of the Scandinavian artefact-types that shift from the male domain to the female. In eastern Europe, where there are both the original Carolingian mounts and local copies, the type continued to belong to the male domain (Skibsted Klæsøe 1999:103, 2001:218 and refs.). Like the equal-armed brooch, this brooch-type belongs to the category of "third brooches", employed in the female costume alongside paired oval brooches to fasten some sort of cape or mantle.

The trefoil brooch is found widely both within Scandinavia and throughout the area that was under Scandinavian influence in the Viking Period. Maixner lists 590 specimens in her catalogue. They are found from Iceland, Britain and Germany to the Baltic, Finland and Russia. The majority of these brooches have been found in Sweden, Norway and Denmark. Just outside what is now Scandinavia, Hedeby has a unique concentration of dozens of brooches. From Russia there are just ten specimens and from Britain and Iceland the figure formerly was barely that high. However metal-detecting has produced several examples in England in recent years (pers. comm. Dagfinn Skre). Maixner also noted 55 moulds, one of which was found in York, one in Gnezdovo and the remainder in Hedeby (Maixner 2005:catalogue). According to Petersen, the trefoil brooches in Norway have a clear concentration in the East, particularly from Romerike and Hedemark down to and including Vestfold (Petersen 1928:94). In graves in southern Scandinavia the type has a distinctly westerly distribution, especially when compared with the distribution of equal-armed brooches. Trefoil brooches are a common item deposited in burials around Hedeby (Capelle 1968:104–5; Hedeager Krag 1994:fig. 9; Eisenschmidt 2004:627–8, fundliste 13 and 13a). The Danish corpus of trefoil brooches has increased rapidly by 200% (Skibsted Klæsøe 2001:23). This is largely as a consequence of finds from settlements and central places. These finds show that the trefoil brooch was more common than the equal-armed brooch in Denmark (Axboe 1992; Tornbjerg 1998:tab. 1.5).

According to Skibsted Klæsøe, the trefoil brooch is the Viking-period artefact-type with the widest

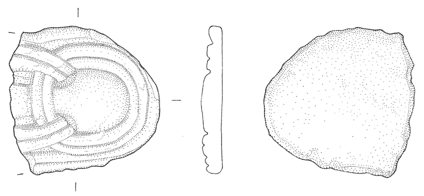


Figure 3.13 *Trefoil brooch (C52517/1459). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

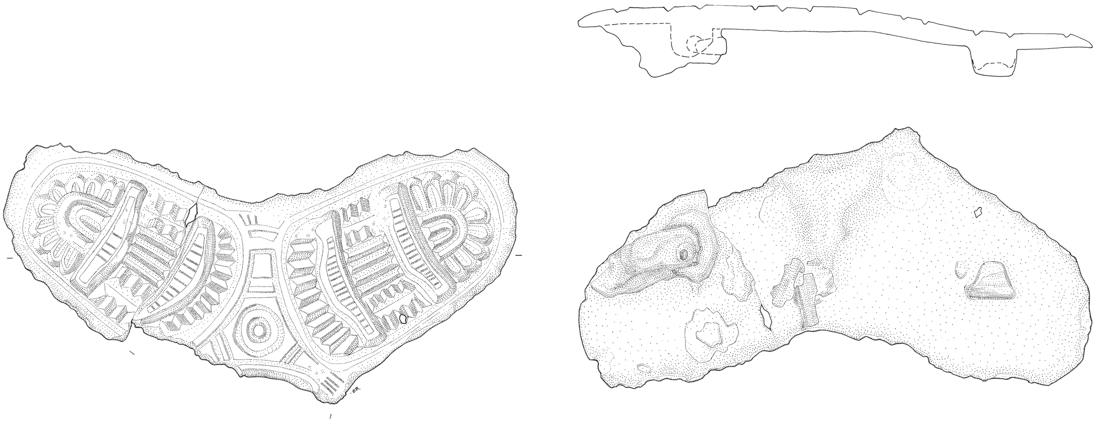
Figure 3.14 *Trefoil brooch (C52516/4101). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

range of variation in terms of decoration. Besides the early trefoil brooches with plant ornament, often highly stylized or simplified, there are later brooches which often have zoomorphic decoration. Skibsted Klæsøe has grouped the Scandinavian trefoil brooches into six types according to decoration. SK type 1 has linear/geometric decoration; SK type 2 early scroll decoration; SK type 3 symmetrical zoomorphic decoration (the Borre Style); SK type 4 acanthus decoration; SK type 5 late scroll decoration; and SK type 6 filigree decoration (Skibsted Klæsøe 1999:104–5). Maixner also classifies the trefoil brooches according to decoration, but into five groups: those with plant decoration (P); those with geometric decoration (G); those with interlace (E); those with combined plaitwork and zoomorphic decoration (F); and those with zoomorphic decoration (Z) (Maixner 2005:30). There is a degree of geographical variation with certain types, such as some with a centre of gravity in Norway and others rooted rather in southern or eastern Scandinavia (Skibsted Klæsøe 1995:114, 1999:106, 2001:217). Petersen dubbed the brooches in the Borre Style "the Norwegian type" as this type was particularly common in Norway – a distributional phenomenon that evidently still holds (Petersen 1928:fig. 97; Skibsted Klæsøe 1999:106; Maixner 2005:catalogue).

Amongst the jewellery found during the recent work at Kaupang, two fragments of trefoil brooches have appeared. There are also two fragments of trefoil mounts, which are discussed in the "Mounts" section, below (p. 55). Charlotte Blindheim reported that seven trefoil brooches had been found in graves at Bikjholberget and two in the settlement area. One of the brooches from the settlement area has stylized plant decoration and one Borre-style decoration. The brooches from the cemetery have plant decoration, plaitwork, geometric decoration and zoomorphic decoration (Blindheim et al. 1999:32–3). According to Maixner's classification, the earlier finds from the graves comprise two trefoil brooches with plant decoration (P), two with interlace (E) and three with zoomorphic decoration (Z). From the settlement layers there is one brooch with plant decoration and one with zoomorphic, while a further brooch with interlace, which lacks a context, may be from a grave (Maixner 2005:cat. nos. 1, 6, 33, 313, 334, 350, 434, 464, 468 and 524). With all of the finds from the settlement and the cemeteries put together, the trefoil brooches form one the major categories of brooch from Kaupang.

C52517/1459 (Fig. 3.13) is a fragment of a copper-alloy trefoil brooch, being the majority of the tongue-shaped lobe, 20 mm long. It is corroded but the decoration is legible. The lobe is decorated with a ring of parallel lines which surrounds part of a plant. Further parallel lines connect the motif on the lobe with the decoration in the lost mid-part of the brooch. At least some of the lines had been striated or beaded. The underside is plane, with no traces of either pin-anchor or catch. The fragment derives from a brooch related to that in Petersen's figure 93 (Petersen 1928:99). One brooch of this type was a stray-find from northern Kaupang (Blindheim et al. 1981:222 and pl. 85). It may have come from a grave (Blindheim et al. 1999:34; Maixner 2005:type E.1.3, cat. no. 313).

In terms of Skibsted Klæsøe's classification, C52517/1459 belongs to type 1d. The principal class, type 1, trefoil brooches with geometric decoration, consists of relatively small brooches. These are found primarily in the Old Danish territories, of Denmark itself plus Skåne and Hedeby (Skibsted Klæsøe 1999:106, 2001:222 and fig. 8–9). Sub-type 1d is reported by Skibsted Klæsøe to be especially well represented on Sjælland, with six examples. Closer counterparts to C52517/1459 are known from, amongst other sites, both Lejre and Holbæk on Sjælland (Christensen 1991:62; Skibsted Klæsøe 1999:fig. 15b, 2001:221). A couple of specimens have been



found in Skåne, while both Öland and Bohuslän have also produced a couple of brooches. Three fragments of this brooch-type have been found at Uppåkra (Skibsted Klæsøe 2001:222 and fig. 8). According to Skibsted Klæsøe type 1d is not represented at Hedeby although one example has been found in excavations at Lübeck in a warehouse that is dendrochronologically dated to AD 817 (Andersen 1981:Taf. 41; Skibsted Klæsøe 2001:222).

In her study of the trefoil brooches, Maixner defined one type characterized by interlace decoration, type E. According to her overview (Maixner 2005:Taf. 38) the Kaupang fragment should be assigned to Group E 1.2. She has recorded 29 specimens of this sub-type. These brooches are almost all found in southern Scandinavia; like Skibsted Klæsøe, she notes that they are clearly concentrated on Sjælland. Amongst these Maixner can identify a further sub-group with its centre of distribution at Tissø and Lejre: these show such great similarities with one another that some form of common source has to be postulated. Other brooches of Group E 1.2, by contrast, are more heterogeneous in appearance (Maixner 2005:126–7, Karte 16, cat. nos. 284–306).

The Kaupang fragment is too corroded for detailed classification. If, however, we look at the brooches illustrated by Maixner (2005:Taf. 38), it is apparent that there is some interesting variance within the group. The ring which surrounds the plane area may be circular, as on the Kaupang fragment, or more oval. In this respect, the Kaupang brooch is related to some examples from Sjælland which are described as belonging to the more heterogeneous group, as well as to one from Våxtorp in Småland.

Brooches related to C52517/1459 (Fig. 3.13) date to an early stage in the Viking Period. Skibsted Klæsøe assigns them to contexts dating from the end of the 8th century and the early 9th (1999:106). Maixner cites only one find-context containing her type E 1.2, a grave from Viborg amt which she dates to the Early Birka Period, the 9th century (2005:60).

C52516/4101 (Fig. 3.14) is a fragment of a large trefoil brooch with two surviving lobes. The maximum dimension is 68 mm and the lobes are 40 mm long measured from the central point. This brooch is in copper alloy and has a whitemetal coating on the raised parts of the face. The cast decoration is very well preserved, with clear relief. The lobes carry decoration consisting of lines connected by raised crossing bands, two on each arm. At the very end of each lobe the lines from U-shaped bows are surrounded by palmette leaves. The central field of the brooch is triangular with concave sides that have two concentric circles in the centre and a few crossing lines. The central field is raised and a corresponding triangular cavity is found on the reverse of the brooch. The underside also has a pin-anchor behind one lobe and the pin-catch, with remains of the iron pin, on the other.

This brooch is largely indistinguishable from the brooch from Jorde, Gol, Buskerud illustrated by Petersen (1928:99 and fig. 92). The decoration on this group of brooches has been interpreted as stylized plant or acanthus decoration (Petersen 1928:101; Skibsted Klæsøe 2001:213). Maixner regards the pattern as a single leaf with an internal structure shown both lengthways and crossways (2005:33).

In Skibsted Klæsøe's classificational scheme for trefoil brooches this is type 4, characterized by acanthus decoration. As she notes, these are amongst the large trefoil brooches (1999:106–7). In Maixner's scheme, the brooch is a variant of the plant-decorated trefoil brooches Group P 9.1 (Maixner 2005:32–3).

This type of brooch is found widely in Scandinavia. In Birka grave 631 there was an example very similar to the Kaupang brooch. It is of the same format as the Kaupang brooch and has traces of whitemetal on the reverse (Arbman 1940:Taf. 73; Hårdh 1984:90). From Uppåkra there is another complete

brooch which differs from the Kaupang piece only in minor details, together with a fragment of a further brooch of the same type. The complete brooch from Uppåkra is of the same size as the Kaupang example. It has traces of reddish gilding on the face and a whitemetal coating on the back (Skibsted Klæsøe 2001:231 and figs. 32–3). Other specimens of this type are known from Hedeby, Denmark, and Löddeköpinge in Skåne. Two examples were already known from Norway: one of them that referred to above from Gol; the other from Hovland, Ullensvang, Hordaland (Petersen 1928:101; Capelle 1968:karte 6; Skibsted Klæsøe 2001 and refs.; Maixner 2005:cat. nos. 179–89). We also have fragments of moulds for brooches of this type of trefoil brooch from Hedeby (Jankuhn 1934:Taf. 47:4, 1977:33; Maixner 2005:Taf. 21:8a).

In its form, proportions, decoration, quality and more, the Kaupang brooch is so similar to brooches from various parts of Scandinavia that we must suppose their manufacture definitely to have been connected at some point. Maixner has compared the decoration on seven brooches of her type 9.1 from Uppåkra and Löddeköpinge in Skåne, Hedeby, Gol in Buskerud, and Ullensvang in Hordaland. She projected the decoration from one of the brooches from Uppåkra on to the other brooches and could show that it was largely identical. The Kaupang brooch should be part of this group too. This may be evidence of serial production. Maixner points out, however, that it is possible for a brooch already made to have been used to produce moulds. Consequently we cannot immediately deduce that all equivalent brooches were made in the same workshop. It is important, in this regard, to consider the reverse of the brooches. When the position of the pin-anchor and pin-catch also agrees, it is more likely that the brooches are from a single workshop. As “siblings”, then, she proposes the brooches listed above, and particularly two brooches from Uppåkra and Löddeköpinge respectively on which not only the decoration but also the elements on the reverse are the same (Maixner 2005:107). Interestingly, the pin-anchor and pin-catch on the Kaupang brooch appear to have been put in the same places. It is plausible, then, that we can suggest some close connexion in production between this and the two specimens from Skåne.

Brooches of this type were probably manufactured in the late 9th century and in use during the first half of the 10th. Skibsted Klæsøe relies in part upon difference in size amongst the brooches as a chronological criterion (1999:106–7). To date type 9.1, Maixner refers to the Hordaland brooch, which was found in a grave whose inventory places it in MVP 2 (defined by oval brooches of the type of Petersen 1928:fig. 51B and D–G; supported by Jansson 1991:268; Maixner 2005:59–62). This means a dating before c. AD 890 according to Jansson (1985:182). Thus Maixner’s and Skibsted Klæsøe’s datings agree closely.

Summary

C52571/1459 belongs to Skibsted Klæsøe’s type 1d and Maixner’s E 1.2. Skibsted Klæsøe reports that brooches of type 1, with geometric decoration, are found almost exclusively in the Old Danish area. They are very common at Hedeby, with 25 examples, and at Uppåkra with 20, while at Birka the total is only four. Sub-type 1d, on the other hand, has not been found in Hedeby, and it is thus conceivable that it was produced somewhere in eastern Denmark (Skibsted Klæsøe 2001:235). According to Maixner’s scheme, brooches with interlace decoration (E) are not represented at Birka even though this is a very numerous group. Group E as a whole is very clearly concentrated in Denmark and Skåne. Four brooches with interlace decoration, but not type E 1.2, were already known in finds from Norway (Maixner 2005:cat. nos. 283–361). C52516/4101

Figure 3.15 *Fragments of trefoil brooches from the fieldwork at Kaupang 1998-2003 (from left: C52517/1459, C52516/4101). Photo, Eirik Irgens Johnsen, KHM.*

(Fig. 3.14) belongs to Skibsted Klæsøe's type 4 and Maixner's type P 9.2, and the type has, as shown above, a wide distribution in Scandinavia. Yet this too is rooted first and foremost in the South. There are five specimens from Hedeby and four from Uppåkra but only one at Birka.

The various sub-types of trefoil brooch have distinctive regional distributions within Scandinavia. Skibsted Klæsøe notes, for instance, that type 5, brooches with late spiral decoration, is represented by six examples from Birka but that it is unknown both from Hedeby and from Uppåkra (1999:106, 2001:fig. 1). Type 5 is also unrepresented amongst the fragments from Kaupang. The new finds from Kaupang are few, and inevitably it is difficult to draw very far-reaching conclusions from this evidence. Nonetheless one may cautiously propose that the corpus is more similar to the material in southern Scandinavia than to that at Birka. This may have a chronological explanation, but is perhaps principally a reflex of the main direction of the network of contacts.

The trefoil brooches found previously at Kaupang, in the cemetery and in the settlement, are of Skibsted Klæsøe's types 1 and 3. These date to the early 9th century and the period from c. AD 900 into the early 10th century respectively (Skibsted Klæsøe 2001). There are also two brooches with plant decoration, of which at least one – possibly both – had been imported from western Europe (Blindheim et al. 1999:33). Blindheim notes that objects with plant decoration are foreign to Scandinavia and must have been brought in through trading sites. Type SK 3, with Borre-style decoration, is, as Petersen had already argued, a type with its roots in Norway. Skibsted Klæsøe also notes that it appears principally in Norway. In Maixner's corpus, the brooches with zoomorphic decoration (Z) are particularly strongly represented in Norwegian finds (Skibsted Klæsøe 1999:106; Maixner 2005:cat. nos. 399–555). Here, then, just as was the case with the equal-armed brooches, we have a type that is common elsewhere in Norway which is represented in the grave goods at Kaupang, but which is not found in the trading and workshop area where the fragments of jewellery reflect rather a southern Scandinavian context.

Just as was the case with the trefoil brooches from the earlier investigations at Kaupang, the two newly found pieces thus paint a diffuse chronological picture. One fragment belongs to the beginning of the Viking Period while the other is part of a brooch-type that is dated to the end of the 9th century or beginning of the 10th.

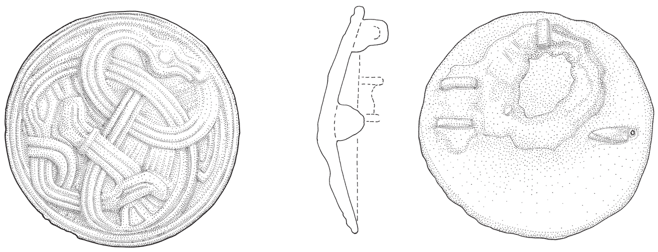
3.3.4 Round brooches

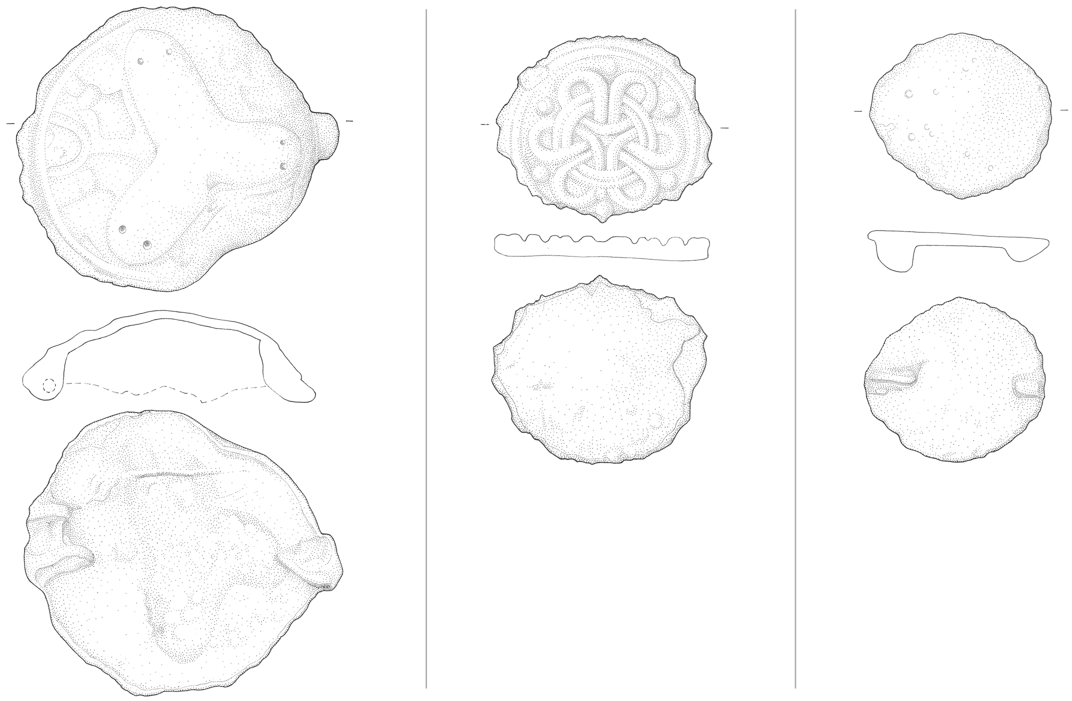
The heading covers a rather diverse group of five brooches which really have nothing in common other than that they are round (C52519/15574, C52517/2071, C52517/957, C52519/14009 and C52517/2092: Figs. 3.16–20). In connexion with his work on the Birka finds, Jansson divided round brooches into large and small categories. His group of small round brooches includes cast copper-alloy or silver brooches and pressed-foil brooches with filigree decoration. The large round brooches at Birka are cast with single or double shells (Jansson 1984a, 1984b). Both types belong in the category of "third brooch". The large round brooches, like the equal-armed and trefoil brooches, served to fasten a cape while the small ones fastened the slit neck of a shirt or blouse (Hägg 1974:18–19).

In Jansson's scheme, the small round brooches are between 24 and 34 mm in diameter while the large ones measure 45 to 73 mm. The new finds from Kaupang consist of five round brooches, four of which are small, as Jansson defines it, and one falls in the gap between those groups.

There are two small round brooches from previous excavations at Kaupang. Both of these have profile animals of the Jelling Style and belong to Jansson's Group I A (Blindheim et al. 1999:34–5). There are two examples of this group from Birka (Jansson 1984a:59). Small round brooches are much more common in Sweden than in Norway, as Heyerdahl-Larsen noted in agreement with Petersen (Blindheim et al. 1999:35).

C52519/15574 (Figs. 3.16, 3.20) is a complete, domed round brooch of copper alloy, 31 mm in diameter. The face carries decoration with ribbons with two or three bosses that may imitate filigree. The ribbons lie in loose loops. A round dot surrounded by a boss at the edge of the brooch is probably the eye of an animal head. On the back of the brooch there is a pin-anchor formed with two rivets and the remains of the iron pin, the pin-catch and a perforated rivet with a small iron ring. This brooch finds a very close parallel in one brooch from Birka





grave 831. On that brooch the decoration is more distinct and shows that the loops form a zoomorphic motif (Arbman 1940:Taf. 70:18; Jansson 1984a: Abb. 8.2, typ I A2). In the figure in Jansson's article it is clear that the same round feature on the Birka brooch does indeed form part of the animal's head.

Jansson counts the Birka specimen amongst the small round brooches: a group of cast brooches with animal decoration classified as type I A2. The Kaupang brooch has to belong to the same group. Jansson described the decoration as a ribbon-like animal with a profile head and a narrow body displayed in loops. The crest of the animal forms a loop around the junction of the neck and the body and ends by the animal's snout. Jansson assigns the animal to the Jelling Style and identifies parallels in the zoomorphic decoration on oval brooches of type P57. He cites finds of type I A from central Sweden, Denmark, Schleswig-Holstein, England and Ireland (1984a:60–1 and Abb. 8.2). The brooch is also, of course, consistent with the two round brooches previously found at Kaupang, already referred to. Wilson also draws attention to the similarity between a brooch found in Dublin and that from Birka grave 831 referred to here (1995:figs. 97–8).

According to Jansson (1984a:72), the small round brooches at Birka are mostly of the Later Birka Period. The datings of the Jelling Style reviewed in the introduction to this chapter assign it to the period immediately preceding or around the year 900 to the middle of the 10th century, or a decade or two after that (Müller-Wille 2001:244–6).

C52517/2071 (Figs. 3.17, 3.20) is a round, domed brooch of copper alloy, 40 mm in diameter. This brooch has a raised trefoil covering much of the face. This is of approximately the same form as a trefoil brooch. At the outer end of each arm of this trefoil are two round pits. Along half of the edge of the brooch there is a moulded rim. The face is uneven, and it is not possible to see if there is any other decoration left. On the back there is a pin-anchor formed by two rivets and the remains of an iron pin. The trefoil element is reflected in a sunken area on the reverse. It is difficult to draw any further conclusions concerning this brooch. It looks most like a large variant of the small cast round brooches. The

Figure 3.16 *Round brooch (C52519/15574). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.17 *Round brooch (C52517/2071). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.18 *Decorated round plate (C52517/957). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.19 *Disc brooch plate (C52517/2092). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.20 *Round brooches from the fieldwork at Kaupang 1998-2003 (upper row, from left: C52519/15574, C52517/2071, C52517/957; lower row, from left: C52519/14009, C52517/2092). Photo, Eirik Irgens Johnsen, KHM.*

group with the Borre Style, Jansson II A (Jansson 1984a:Abb. 8.2), has a trefoil zone in the centre. However this brooch from Kaupang is larger, more convex, and more solidly formed than those.

C52517/957 (Figs. 3.18, 3.20) is a round, decorated copper-alloy plate, 29 mm in diameter. It carries regular relief decoration. A ribbon has been formed into three volutes with a circular band woven into the volutes. Along the edge there are six round, raised dots. Around the ribbon motifs runs a circular rim-moulding. The decoration might be identified as a variant of what is known as the Terslev design, related to the Borre Style (Wilson 1995:106–7). As the back of the piece is completely smooth, it is conceivable that there had been a border here, possibly of beaded, twisted or plaited wires, upon which the pin-anchor and -catch had sat. Another possibility is that this was a model for the production of moulds, or even a patrix die for the production of pressed foil. The plate is quite thick, which supports the idea of it having been a die.

The Terslev design, named after a hoard from Sjælland, appears both on cast copper-alloy brooches and pendants and on jewellery of silver and gold. In the latter cases the pattern is executed in filigree and granulation. Both cast and pressed-foil versions appear in Birka graves. The cast brooches belong to Jansson's category of small round brooches, Group III, primarily type III B, which have a design composed in the same way as the Terslev design. Jansson compares this with the filigree brooches of his type V A (Jansson 1984a:63–7 and Abb. 8.2). Terslev brooches with filigree decoration are known mostly from hoards dated to the 10th century (Jansson 1984a:66 and refs.; Hårdh 1976). A fragmentary gold filigree brooch with this design was part of the Vester Vedsted board with a t.p.q. of 913. This find is dated by ten Islamic coins dating from 892–913 (Skovmand 1942:72–3; Hårdh 1996:191). In chamber-grave no. 5 at Hedeby, there were two Terslev pendants of gold and two filigree-decorated oval brooches which allow us to date the grave to the last quarter of the 9th century. These two pendants are apparently the oldest preserved pieces of jewellery in the Terslev Style (Eilbracht 1999:140–3). The early examples of Terslev decoration from Vester Vedsted and Hedeby may be imported items from the Continent. Eilbracht points out that these find-places are associated with Schleswig and Ribe, both places where churches were founded a few decades later. The design has been linked to missionary activity and the adoption of new religious beliefs (Eilbracht 1999:147). Patrix dies, for the production of pressed-foil brooches with Terslev designs, are known from

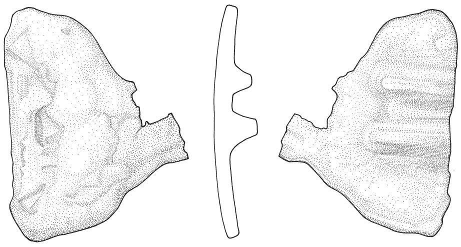


Figure 3.21 *Brooch-fragment (C52517/116). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.22 *Silver Thor's hammer (C52517/2458). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.23 *Copper-alloy Borre-style pendant (C52519/15915). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.24 *Thor's hammer (C52517/2458) and Borre-style pendant (C52519/15915) from the fieldwork at Kaupang 1998-2003. Photo, Eirik Irgens Johnsen, KHM.*

various sites in southern Scandinavia, such as Tissø, Hedeby and Lund. All of these are of about the same size as the piece from Kaupang (Capelle 1968:Taf. 28, 1, 3 and 5; Jørgensen and Pedersen 1996:fig. 14). One of the dies from Hedeby has a design that is very similar to that of the Kaupang plate (Armbruster 2002:Taf. 5.3). It is important to note here that all of the round dies from Hedeby, and those from Uppåkra and Lund, are domed – in contrast to the Kaupang find being discussed here (Capelle 1999: 222–3; Armbruster 2002: 251–6 and Tafn. 1–5).

The Kaupang object is related to the Terslev design, but with its three volutes rather than four, and the absence of the cruciform element in the centre, it has to be considered a variant, which makes it less easy to date. The cast brooches with the Terslev design should probably be regarded as copies of the filigree objects. In the case of the piece of metalwork under consideration here, we have gone one step further from the prototype.

C52519/14009 (Fig. 3.20) is a small copper-alloy disc brooch, originally round or oval with a flat face and a maximum dimension of 25 mm. The face is severely corroded but has traces of decoration that is, however, difficult to read. On the back there are remains of the pin-catch and -anchor. It is very difficult to classify this brooch by type. Its slightly domed shape points most probably to Jansson's type "kleine Rundspangen" II D/III D, which would date it to the Later Birka Period (Jansson 1984:62–74). Another possibility is that parallels to this item can be found in Ørsnes's Group I 1: circular plate brooches with a flat back and punched decoration. Ørsnes listed twelve specimens from southern Scandinavia and proposed that this is a southern Scandinavian type found primarily in the regions of western Denmark. The origin of the type, in his view, was probably to be sought in England (Ørsnes 1966:128–33 and figs. 130–3). Jørgensen states that simple round disc brooches belong to the earliest phase of the Vendel Period/Danish Late Germanic Iron Age (1994:Abb. 124.4). If this context is correct, this was an old dress-accessory which may have been in circulation for a long time and is probably to be regarded as scrap metal.

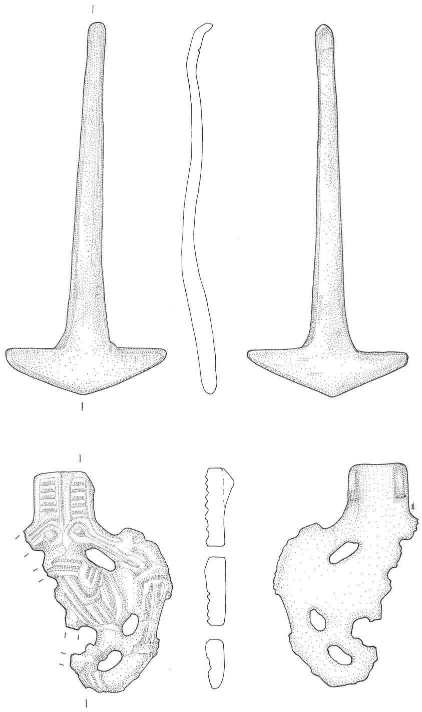
C52517/2092 (Figs. 3.19, 3.20) is a round or slightly ovoid brooch of copper alloy, of the same type as that just discussed, 24 mm in diameter. The face is plane with no sign of decoration. On the back there are remains of a pin-catch and -anchor in the form of one rivet and traces of a second. The plane upper side may mean that this brooch is an example of the aforementioned Vendel-period type.

3.3.5 Other brooches

C52517/116 (Fig. 3.21): a copper-alloy fragment, 31 mm long. There are two rivets from a pin-anchor on the back, indicating that this is part of a brooch. On the face there are traces of punched decoration in the form of small triangles. The surface is severely corroded. This fragment has been cut around the pin-anchor and it is difficult to form an opinion as to what type of brooch it comes from.

3.3.6 Pendants

C52517/2458 (Figs. 3.22, 3.24) is a complete Thor's hammer in silver, 50 mm long. It is smooth and undecorated. The head of the hammer is wide, with slanting sides that meet at a blunt angle. The shaft is unusually long, and tapers towards the end. The end of this long shaft is rounded and slightly bent. It was probably meant to be bent into a suspension loop, and this may mean that it is an unfinished pendant. On the back of the shaft, however, there are two



transverse cuts towards the end. It is also possible that the intention was to cut off a piece of the shaft as hacksilver, which may have been used as currency. A Thor's hammer of the same type, undecorated and with an equally long shaft, had already been found at Kaupang. This may be evidence of the local manufacture of this form (Blindheim et al. 1981:pl. 55).

C52519/15915 (Figs. 3.23, 3.24) is a fragment of a copper-alloy pendant with cast decoration, measuring 20 mm x 31. Only half of the pendant is left. It was perforated, with three oval openings remaining. It is decorated in the Borre Style, with a round-eyed full-face mask. A long ear-tuft runs out from the mask, and a clear gripping paw is preserved. The body parts are ribbon-like and striated lengthways. Connected to the animal head is a ribbon-shaped suspension-arrangement. This is decorated with parallel lines which divide it vertically into two fields which in turn have transverse striation. Two small rivets on the back must have had something to do with the suspension. These, however, have not been perforated, which should imply that this pendant is unfinished. Its back is flat.

This type of cast pendant with Borre-style decoration is widely distributed geographically and was produced both in silver and in copper alloy. There is a fine example in a large silver hoard at Gnezdovo near Smolensk (the first of several silver hoards found at Gnezdovo). The Gnezdovo pendant is not identical to that from Kaupang, although it does display a variant of the same design. The suspension-arrangement with the two rivets was executed in the same manner. Another parallel is known from the Vårby hoard from Huddinge in Södermanland, which dates to around AD 940 (Wilson 1995:94, figs. 67 and 72). The wide geographical range is exemplified by another fine specimen from Little Snoring, Norfolk (Paterson 2002:267–8).

According to Callmer, this type is found widely in Scandinavia, with a clear centre of gravity in the Mälar region. He also cites examples from Iceland, Finland and Russia. One specimen is from Hedeby. Callmer divides the pendants with Borre-style decoration into three groups. These show that there were eastern and western Scandinavian variants. All of the examples from eastern Scandinavia have prominent ears with the full-face mask that stick up on both sides of the suspension loop. The western

Figure 3.25 *Silver fragment with zoomorphic decoration (C52517/950). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

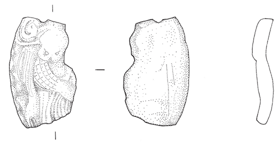


Figure 3.26 *Knob, possibly from a disc-on-bow brooch (C52519/14294). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

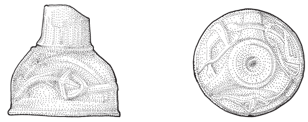


Figure 3.27 *Silver fragment with zoomorphic decoration (C52517/950). Knob, possibly from a disc-on-bow brooch (C52519/14294) from the fieldwork at Kaupang 1998-2003. Photo, Eirik Irgens Johnsen, KHM.*

variant, of which the Kaupang find is a representative, lacks these prominent ears. Callmer called the western Scandinavian variant type Skemo and listed five specimens from Norway and one from western Sweden. Moulds for pendants like those from eastern Scandinavia have been found in Hedeby, showing that in many cases the relationship between manufacture and distribution is complex (Callmer 1989:24, 40 and Abb. 3.33; cf. Petersen 1928:159). A pendant from Tissø on Sjælland is also of the type with long and prominent ears (AUD 1999:239; Jensen 2004:477).

3.3.7 Fragments of brooches or pendants

C52517/950 (Figs. 3.25, 3.27) is a silver fragment measuring 8 mm x 14. Its slightly rounded edge has been preserved although the piece is cut on three sides. It carries cast decoration in low relief. Along the edge there is ribbon-decoration consisting of parallel ridges. This is clearly zoomorphic. A small leg and paw are quite visible. One area with a squarish pattern is evidently part of a limb. It may also be possible to make out a head and ears. This fragment has traces of gilding on the face. The leg with the small paw allows us to classify the decoration as in the Gripping Beast Style. The back is uneven, with a flat ridge following the line of the edge. The decoration is reminiscent of that on an early oval brooch from Hovinsholm, Hedmark (Rygh 1885:fig. 644; Petersen 1928:fig. 10).

C52519/14294 (Figs 3.26, 3.27) is a hemispherical copper-alloy knob with a conical hollow protuberance on the top, 14 mm in diameter and 14 mm high. This knob carries decoration in high relief. Three flat areas, more or less trapezoidal, run from the protruding section down to the edge. The three fields between these are filled with zoomorphic decoration, one animal in each part. In the field with the clearest decoration, a head, a leg and a paw can be seen. A notched ridge links the decoration in the three fields. The back is concave with a prong or rivet in the centre. This knob has probably come from a disc-on-bow brooch of the same type as that in a grave at Barshalder, Gotland (Thunmark-Nylén

1995a:Abb. 82.1). On the Gotlandic disc-on-bow brooches it is usual for the knobs to be perforated. On Gotland, disc-on-bow brooches with perforated knobs and interlace decoration date to the Vendel Period, while those with ribbon- or gripping-beast decoration date post-800 (Thunmark-Nylén 1995b:563–4). A disc-on-bow brooch with a hemispherical, perforated knob was found in boat-grave 35 at Tuna i Badelunda (Nylén and Schönbeck 1994:figs. 32, 24 and 36). This brooch has been dated to the end of the 8th century or the transition to the Viking Period (Nylén and Schönbeck 1994:38).

Figure 3.28 *Fragments of arm- and neckrings from the fieldwork at Kaupang 1998–2003. 1: Armring, copper alloy (C52517/1979). 2–11: Ribbon-shaped armrings, silver (C52517/194, C52517/880, C52519/14058, C52517/207, C52517/792, C52517/971, C52517/622, C52517/2120, C52517/2191, C52517/2739). 12: Armring from rod, silver (C52517/2054). 13–14: Double neck- or armrings, silver (C52517/1954, C52517/2151). 15–17: Rings of Duesmine type, silver (C52519/14955, C52519/15036, C52519/15562). Photo, Eirik Irgens Johnsen, KHM.*

3.3.8 Arm- and neckrings

C52517/1979 (Fig. 3.28.1) is very probably a fragment of a copper-alloy armring. It measures 31 mm x 15. The fragment is ribbon-shaped and slightly curved. Its decoration consists of deeply stamped half-moon punchmarks. In the centre of the fragment the curved punchmarks have been stamped in pairs to form a wave-pattern. The two surviving wavy motifs are positioned symmetrically but do not run in the same direction. This probably shows that it is the centre of the armring that has been preserved. Around the wave-like figures there are a number of individual bow-shaped impressions. The punchmarks are so deep that the sides of the strip had been pushed out to have a wavy contour of their own. In the centre of the piece are two bow-shaped impressions with their open sides towards the edges of the piece.

Petersen wrote that armrings with curved decoration are the most common type from Viking-period Norway. This type derived from the preceding period. In Viking-period Norway it is associated primarily with the first half of the 9th century (Petersen 1928:153 and fig. 184; Jørgensen and Vang Petersen 1998:fig. 206). This type of punched decoration on the armring is well known from the Viking Period, not least on Gotlandic armlets (Stenberger 1958:109). Similar deeply punched decoration is also very familiar on rings from Denmark and western Scandinavia (Stenberger 1958:111). In a chamber-grave at Birka there was a well-made armring with wavy decoration of deeply stamped half-moon punchmarks. This was associated with oval brooches of type P51 and a large equal-armed brooch of Arbman's type III (Arbman 1940:450 and Taf. 109:3; Aagård 1984:Abb. 11.2). This dates the grave to the

Later Birka Period. Ørsnes also illustrated rings with this form of decoration, which he assigned to the transition from the Late Germanic Iron Age/Vendel Period to the Viking Period (1966: 224).

Decoration using half-moon punchmarks to form a wavy line has old parallels. It is the most common decoration on the large gold neckrings of the Migration Period (Jørgensen and Vang Petersen 1998:figs. 164 and 171). A couple of new finds from Bornholm include fragmentary trefoil mounts or brooches of thin silver sheet together with fragments of armrings, also of thin silver sheet, with punched bow-shaped decoration and small stamped rings. These finds have been dated to the Viking Period (AUD 1996:240–1). The armring from Kaupang is thus difficult to date except within broad limits, although its close similarity to the lead armring (C52519/21224: cf. Pedersen, in prep.) that was found in a datable context may give us a closer date. The lead ring was found in Plot 1A, SP I. This means that it was in a layer of the first phase of Kaupang, c. AD 800 to 805/10. Since the decoration on the lead armring is very like that on the fragment discussed here, its date may be significant in dating C52517/1979.

C52517/194 (Fig. 3.28.2) is a fragment of silver, ribbon-shaped and 42 mm long. It tapers a little towards one end and has been cut at both ends. It is decorated with transverse, slanting and smooth punchmarks and is probably part of an armring (cf. Hårdh 2008:fig. 5.13).

C52517/880 (Fig. 3.28.3) is a ribbon-shaped fragment of silver, 35 mm long. It has small square punchmarks with tiny triangles in each corner and a raised dot in the middle. It has been cut at both ends and is widest in the centre. It probably comes from an armring. Here again it is probably the middle of the armring that has been preserved.

C52519/14058 (Fig. 3.28.4) is a ribbon-shaped fragment of silver, 28 mm long. It has been cut at both ends and is decorated with small V-shaped punchmarks which combine to form transverse zigzag lines. This probably comes from an armring (cf. Hårdh 2008:fig. 5.13).

Ribbon-shaped armrings with transverse punched decoration are common finds in Danish silver hoards from the period before and around the year 900 (Skovmand 1942:28–37). The transverse lines of punchmarks are often combined on complete Danish rings with a cross-motif in the centre of the ring (Skovmand 1942:figs. 2, 4 and 5; Munksgaard 1970). This design is also commonly met on ring-jewellery from Britain and Ireland. The objects are often referred to as Hiberno-Viking broad band rings. The origin of these rings is probably to be sought in Denmark (Sheehan 1998:195; Brooks and Graham-Campbell 2000:76). Sheehan emphasizes that this points particularly to links between Denmark and Ireland (2001:58).

Three ribbon-shaped, punch-decorated silver fragments are probably from armrings. There are three decorated with transverse lines of punchmarks: C52517/207 (9 mm x 7: Fig. 3.28.5); C52517/792 (14 mm long: Fig. 3.28.6); and C52517/971 (14 mm: Fig. 3.28.7). There are four further ribbon-shaped, punch-decorated rods that are likely to derive from armrings: C52517/622 (17 mm x 14: Fig. 3.28.8); and C52517/2120 (11 mm x 5: Fig. 3.28.9); C52517/2191 (14 mm x 6: Fig. 3.28.10); and C52517/2739 (31 mm long: Fig. 3.28.11).

C52517/2054 (Fig. 3.28.12; Hårdh 2008:fig. 5.14) is a fragment of a silver armring, clearly from a hammered rod, round in cross-section, the ends of which have been joined in a simple knot. It is 39 mm long. The ring has been cut on either side of the knot so that only this remains. The ring belongs to one of the commonest types of silver armring, a Scandinavian form that was probably manufactured in various parts of Scandinavia over a long period. Through its presence in silver hoards the connexion between this type and the 10th century is clear. There is some evidence that it was already in production in the 9th century. The Jutlandic hoard from Vester Vedsted, t.p.q. 913, contained five gold armrings, one of which has this simple fastening arrangement (Jørgensen and Vang Petersen 1998:298–9). The same type of knot is found on the large gold neckring from Hoen in Buskerud. This find is coin-dated to the 860s, although other parts of the assemblage may indicate that it was deposited in the last quarter of the century (Fuglesang and Wilson 2006).

C52517/1954 (Fig. 3.28.13; Hårdh 2008:fig. 5.14) is a silver rod of faceted cross-section. It is twisted and bent and cut at both ends. It is about 130 mm long. It is clear that this is a fragment of a double neck- or armring. This is a type of jewellery that is extremely common in Scandinavian silver hoards, both whole and fragmented. The production of these rings had begun by c. 900 at least, but they evidently remained in production for a long time, probably for most of the 10th century. They are amongst the common forms of jewellery of Viking-period Scandinavia and were also made in various parts of Scandinavia and around the Baltic (Hårdh 1996:41–5; Graham-Campbell 1999).

C52517/2151 (Fig. 3.28.14; Hårdh 2008:fig. 5.14) consists of two silver rods of round cross-section, c. 70 mm long. These are twisted around one another and cut at both ends. They are also very probably from a neck- or armring of two rods. The body of the ring was therefore of the same type as that inferred for the previous fragment.

Three punch-decorated silver rods C52519/14955 (bent length c. 80 mm: Fig. 3.28.15; Hårdh 2008:fig. 5.12), C52519/15036 (19 mm: Fig. 3.28.16; Hårdh 2008: fig.5.12) and C52519/15562 (11 mm: Fig. 3.28.17; Hårdh 2008:fig. 5.12), and ten spiral striated silver rods

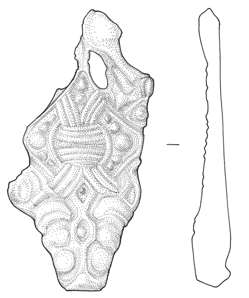


Figure 3.29 *Pin with Borre-style decoration (C52517/718). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

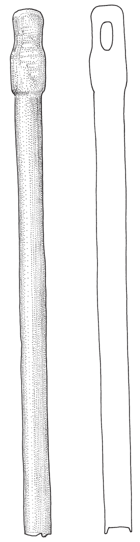


Figure 3.30 *Pin with rectangular head (C52519/20381). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

C52517/408 (length 17 mm: Hårdh 2008:fig. 5.10), C52517/466 (length 26 mm), C52517/469 (length 37 mm: Hårdh 2008:fig. 5.10), C52517/998 (length 19 mm), C52517/1088 (length 26 mm: Hårdh 2008:fig. 5.10), C52517/2442 (bent length c. 35 mm), C52519/14893 (length 19 mm: Hårdh 2008:fig. 5.10), C52519/14913 (length 8 mm), C52519/15819 (length 14 mm) and C52519/17264 (length 12 mm: Hårdh 2008:fig. 5.10) are probably a total of thirteen fragments of rings of the Duesminde type. This is a familiar feature of southern Scandinavian (Danish) hoards dating pre-900. The discussion of these rings has largely concerned itself with where they were made, with southern Scandinavia and Russia having been proposed (Skovmand 1942; Munksgaard 1980; Hårdh 1996:139 and refs.; Graham-Campbell 1999; Hårdh 2008:108–13).

3.3.9 Pins

C52517/718 (Fig. 3.29) is a copper-alloy fragment measuring 38 mm x 19. It may be from a ring-pin of Thunmark-Nylén's type V (Thunmark-Nylén 1984: 9–10). This piece has some openwork decoration including one oval open area and part of another placed symmetrically alongside the first. The object terminates in a full-face mask with a stubby snout, sharp round eyes and semicircular, projecting ears. The surface is otherwise filled with a ring-chain motif combined with round knobs. The decoration is a fine specimen of the Borre Style, and is of high quality. There is also some trace of gilding. The back is flat with no sign of any fastening mechanism.

Ring-pins of type V are found, according to Thunmark-Nylén, in richly furnished graves, primarily chamber-graves containing weaponry. They are distinctly eastern Scandinavian in distribution with a concentration around Mälaren and in the Scandinavian-influenced regions of the Ukraine and Russia (Lethosalo-Hilander 1982:fig. 32). One specimen that displays close similarities to C52517/718 is from Namdalseidet, Beitstaden, Nord-Trøndelag (Petersen 1928:fig. 227). A fragment of a similar ring-pin with Borre-style decoration was previously found in the settlement layers at Kaupang (Blindheim et al. 1999:41–2). Several ring-pins with Borre-style decoration have been found at Birka (Arbman 1940:Taf. 42; Wilson 1995:figs. 62–5).

C52519/20381 (Fig. 3.30; cf. Graham-Campbell, this vol. Ch. 5:104) is a copper-alloy pin with a rectangular head with an oval perforation. The pin itself is round in cross-section and the point is broken off. It is 70 mm long. This is probably a ring-pin that has lost its ring. The material on one side of the opening is thin, which indicates that the pin has been worn. Two similar pins were already known from Kaupang. Blindheim referred to them as pins of a Vestfold type because they are common in the Kaupang area. She refers to similar pins from various parts of Scandinavia (1976:20–2). A similar pin is known from a boat-grave at Kiloran Bay in Scotland (Graham-Campbell 1995:159). This Kaupang pin is from a dated context, Plot 1A, Site Period II. This means that it derives from the phase of permanent settlement dated 805/10–840/50 (Pedersen and Pilø 2007:fig. 9.2).

3.3.10 Mounts

C52519/14961 (Fig. 3.31) is the cut-off lobe of a trefoil mount, measuring 25 mm x 18. The front side carries regular and well-executed spiral decoration in relief consisting of several parallel lines. On the back there are the remains of two rivets for attachment which have been cut so that half of the perforations remains as two semicircular cavities. There are two very good counterparts to this mount in the National Museum of Scotland. These are both trefoil mounts, one from Skipton-on-Swale, North Yorkshire, and the other from Ewerby, Lincolnshire. Both specimens have similar decoration and paired rivets on the back of each of the three lobes. Both of these English finds were found by metal-detecting in the 1996. A fragment of a comparable mount or brooch has come from Jarlshof on Shetland. There are also a couple of parallels in Iceland, from Hafurbjarnarstöðum and Hóli (Paterson 1999).

C52519/15943 (Fig. 3.32) is a fragment of a trefoil mount of the same type as the previous, measuring 15 mm x 37. It consists of one lobe with a bit of the central field. The surface is heavily corroded but there are traces of spiral decoration like that on the previous example. In combination with the spiral decoration is a plaited pattern of ribbon-like elements. On the back of the lobe are the remains of two rivets for attachment: these have been ground down so that only the base of the rivets remains. In the centre of the front of the mount there is a round raised dot which is also visible as a cavity on the front. This round central point has direct parallels on both the English and the Icelandic mounts referred to above. These two are mounts of the same type which should be considered along with the five specimens cited from Iceland, England and the Shetlands. This type thus is clearly based in the North Sea and North Atlantic zones. Paterson associates the decoration with the Mammen Style but would nevertheless date the type to the first half of the 10th century (1999:137). Signe Horn Fuglesang argues that the decoration is in the late Jelling Style, possibly a transitional phase to the Mammen Style, stylistically comparable with a fragment of wood from the North Mound at Jelling. The dating should then be c. 940–950 (pers. comm., Signe Horn Fuglesang).

C52517/724 (Fig. 3.33) is a cruciform mount of copper alloy with traces of gilding. It measures 37 mm x 37. The centre is raised as a cone and the four arms of the cross have almost heart-shaped terminals. Ribbon-like ridges run from the conical centre to form a cross. The remains of gilding are best preserved in the sunken areas in the centre of the mount. This object is otherwise heavily corroded so that the decoration cannot be determined further. Three of the arms carry a knob on the back for attachment to some underlay. The fourth arm has a triangular cavity on the back.

The heart-shaped terminals of the arms are probably animal heads viewed face-on. If this is the case, the mount is closely connected to a group of square brooches decorated in the Borre Style with an animal head in each corner. This type of brooch is familiar in southern Scandinavia, at Uppåkra, Hedeby and various sites in Schleswig-Holstein (Capelle 1968:Taf. 9:2–3; Müller-Wille 1986:Tafn. 76, 77:1 and 102; Eisenschmidt 2004:Tafn. 97:13 and

Figure 3.31 *Trefoil mount (C52519/14961). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

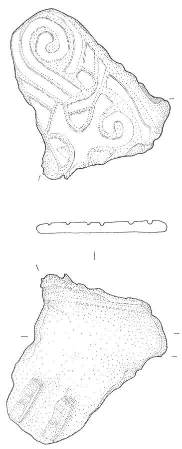
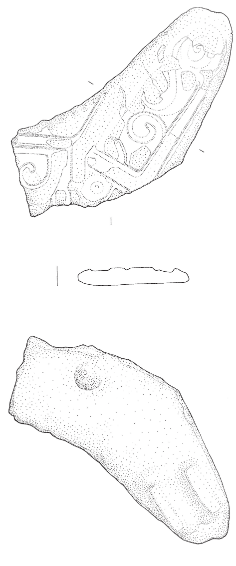
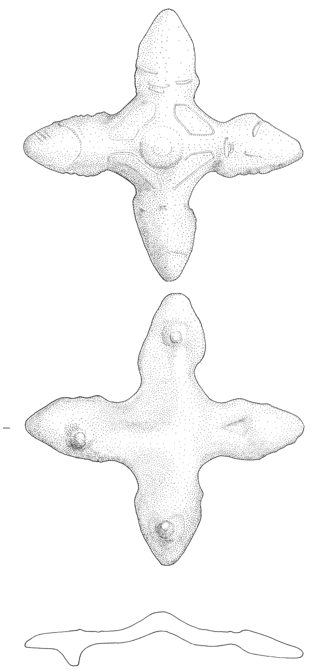
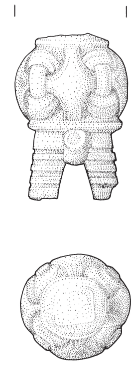
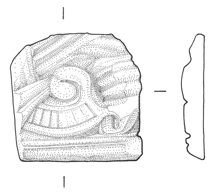
Figure 3.32 *Trefoil mount (C52519/15943). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.33 *Cruciform mount (C52517/724). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.34 *Mount, possibly from a knife handle (C52519/15694). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 3.35 *Gilt mount with zoomorphic decoration (C52519/14926). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

101:5). One fragment was found at the landing place of Vester Egeborg on Sjælland (AUD 1997:219; Ulriksen 1998:fig. 134a). The Vester Egeborg mount, like the majority of those from Schleswig-Holstein, has a central field with ridges that run out from a round knob which is surrounded by a circle to form a cruciform motif. This is pretty much identical with the arrangement on the Kaupang mount. The Kaupang mount is thinner than the majority of the northern German examples. One specimen that is very similar to the Kaupang mount is from Västerås in central Sweden (Capelle 1968:Taf. 23:14). According to Müller-Wille, these brooches were derived from bridle-mounts found in equestrian graves that had been copied and modified into rhomboidal and cross-shaped brooches with animal heads in each corner (Müller-Wille 1977:Abb. 3:1–3, 1987:40). The Borre Style is dated from the later part of the 9th century to the first half of the 10th. Its peak is usually placed around 900 (Müller-Wille 2001:244–6). The dating of the mounts and of the related brooches has been assigned to the first quarter of the 10th century by Skibsted Klæsøe (1999:97 and 124). Two brooches of forms similar to that of the Kaupang mount have also been found in separate graves at Tuna i Badelunda. These, however, are dated by Nylén and Schönbäck to the second half of the 10th century (Nylén and Schönbäck 1994:84 and 90, and figs. 73 and 77). Müller-Wille dates as a whole the cemetery at Thumby-Binebek, where several mounts of this type were found, to the first and second thirds of the 10th century (1987:91). Eisenschmidt is of the opinion that a mount from Thumby-Binebek that is thinner than the others and even more styl-

ized may be somewhat later than the remainder (1994:157). This is the mount that corresponds most closely to that from Kaupang (Müller-Wille 1987:Taf. 77:1).

C52519/15694 (Fig. 3.34): a copper-alloy mount, measuring 22mm x 14, possibly the terminal of a knife-handle or something similar. A globular body with a thin, cylindrical element at the upper and lower edges. The upper side carries traces of rust, possibly the remains of a nail. This globe is silver-plated, and a ring-chain with rhomboidal fields of the Borre Style runs around it. Two grooved rivets protrude from it. These have inlays of some other material. Between the rivets there are the remains of partly plied threads (cf. Arbman 1940:Taf. 70:7).

C52519/14926 (Fig. 3.35): a copper-alloy fragment with traces of gilding on the face, measuring 17 mm x 17. The back is plane. This object came from an undisturbed layer but outside the area of excavation in 2002. The layer can be dated to Site Periods I–III, which is a very broad range, 800–900 (Pedersen and Pilø 2007:186). The decoration has been executed in law relief and may display a backward-facing animal. The narrow, fluted body and the band that runs across it are reminiscent of a Jelling-style animal with its crest. The Jelling Style is usually dated from around 900 through the first half of the 10th century.

3.3.11 Types not represented amongst the finds

It is quite remarkable that there are practically no fragments of oval brooches amongst the new finds from Kaupang. During the cleaning of unidentified copper-alloy fragments one piece of a single-shelled brooch appeared (information kindly supplied by Unn Pedersen). From the earlier work at the site there is quite a large collection of oval brooches. Blindheim refers to 39 specimens from the graves at Bikjholberget. Nine graves at southern Bikjholberget/Lamøya contained oval brooches and twelve at northern Bikjholberget. Two fragments of oval brooches have been identified from the earlier excavations in the settlement area (Blindheim et al. 1999:29–30). Jansson avers that the oval brooch is the most frequent Scandinavian brooch-form between Ireland and Iceland in the West and the Dniepr and Volga in the East (1985:12). At settlement sites explored with metal-detectors, like Kaupang, or Uppåkra, such brooch-fragments are commonly found. With their fully decorated upper surfaces they are also readily identifiable even from tiny fragments. Their extreme paucity in the plough-layers at Kaupang is startling. One explanation could be that oval brooches were more at home in the northern and eastern regions of Scandinavia, while the graves around Hedeby show that a Continental style of dress with just one brooch was adopted earlier here (Hedeager Krag 1994:55). At an earlier point in this chapter it was shown that the finds from the graves at Kaupang differ to some extent from what has been found in the settlement. This may show that the fragments from the settlement area consist in part of scrap metal circulated from southern Scandinavia. However the case for that does not stand. According to Hedeager Krag (1994:58), the change in costume-style only appears in the 10th century in southern Scandinavia, implying that oval brooches were in use there in the 9th. Blindheim has also shown that the majority of the oval brooches at Kaupang are from the earlier Viking Period. She argued that they demonstrated connexions both with the South and the West, while local production within Kaupang could not be ruled out (Blindheim et al. 1999:31). Another possible explanation is a chronological one. It is of interest, in the present context, that a clay mould bears the impression of a brooch of type P37 (pers. comm. Unn Pedersen): precisely, a single-shelled brooch of an Early Viking-period type. Jansson claims that P51 is the most common type practically everywhere. At Birka it accounts for 47% of the whole corpus. Type P51 is associated with the Later Birka Period which, as noted, ought to begin sometime in the second half of the 9th century (Jansson 1985:181–2). This type is absolutely predominant in the plough- and culture layers at Uppåkra (Tegnér 1999:230–1; Hårdh, 2010).

The typically "Norwegian" brooches of the equal-armed and trefoil types (Petersen 1928:figs. 60–1, 64–6, 76, 97–115 and 142) are absent from the settlement layers at Kaupang but are found in the graves (Maixner 2005:cat. nos. 434, 464 and 468). According to Skibsted Klæsøe, the "Norwegian" equal-armed brooches belong to a period from the beginning of the Viking Period through to the middle of the 9th century, while the trefoil brooches run from the early 9th century far in to the 10th (Skibsted Klæsøe 1999:103 and 106). Maixner assigns the majority of the trefoil brooches of this type to MVP2: around 900 or in the very early 10th century (Maixner 2005:190).

The lack of fragments from oval brooches in the settlement finds from the recent excavations is thus yet another indication that the material from the settlement area is rather different from that which appears in the graves at Kaupang. The reason may be that the settlement area saw less activity in a particular period, or that the finds from the settlement consist of a selection of scrap metal that was in circulation which had a different source from the material that ended up in the graves.

The difference that a small quantity of objects seems to reveal between the material that came to rest in the stratified deposits of a settlement and what was deposited in the graves around that settlement site implies a fascinating contrast in the use of metal artefacts. It is to be hoped that the question will be more fully answered through the analysis of the most recent finds from the Black Earth at Birka and as a result of new metal-detector investigations at Hedeby.

3.4 The dating of the objects from Kaupang

The dating of the various objects of Scandinavian origin has been discussed throughout the above. One brooch was probably made as early as in the Migration Period. Two equal-armed brooches and possibly a round one too are types that derive from the late Vendel Period (Norwegian Merovingian Period/Danish Late Germanic Iron Age) or the beginning of the Viking Period. A high proportion of the fragments of jewellery and other decorated items of Scandinavian types that could be dated derives from the period around the year 800 or the early 9th century. A modelled quadruped animal and a domed knob are dated by parallels to the Later Birka Period; likewise one round brooch with cast decoration. This really does not mean anything more than that these may have been manufactured around the year 900. How far into the 10th century these types continued to be made we do not know. One trefoil brooch has been dated to the late 9th century or Middle Viking Period, MVP 2. The latter should denote the late 9th century or around the year 900. The latest objects that could be dated are the two trefoil mountings in the late Jelling Style, possibly transitional to the Mammen Style. These have been dated, as noted above, to c. 940–950.

A small quantity of items, three pieces in all, are decorated with gripping beasts or probable gripping beasts. Four objects have decoration that can be classified as the Borre Style or possible Borre Style, while two or three are decorated in the Jelling Style. According to the surveys made by Müller-Wille referred to above, the various Viking-period styles have usually been assigned a duration of fifty years or more. Fuglesang and Wilson have assigned the Gripping Beast/Oseberg Style to the period 800–875. Three dendrochronological datings of the style all fall in the first half of the 9th century. The Borre Style is dated by Fuglesang to 875–950 and by Wilson to 850–950. The five dendrochronological datings that Müller-Wille lists lie clustered either side of the year 900. The Jelling Style is dated, as noted above, between 900 and 950 by Fuglesang, while Wilson gives it a longer range, from before 900 to 980. There are three dendrochronological dates around 900 and one after the middle of the 10th century (Müller-Wille 2001:244–5 and refs.). These datings thus do not contradict the datings of the brooches and other objects from Kaupang that have been discussed here.

The typological and stylistic datings of the Scandinavian jewellery and mounts from Kaupang thus point to a cluster around the year 800. The evidence that we have for the manufacture of jewellery, in the form of some lead models and a fragment of a mould, points to jewellery production at least in an early phase at Kaupang (Pedersen, in prep.). The objects with counterparts that are dated to the Later Birka Period or are decorated in the Jelling Style could very well have been made in the decades around 900 although even later datings cannot be ruled out. The two trefoil mounts dated to the middle of the 10th century seem, however, to stand chronologically isolated. The two are very similar to one another and they could have reached Kaupang together.

A high proportion of the objects discussed are fragments of cast copper-alloy jewellery. This may cause us problems in chronological terms as cast objects may be copied long after the original was produced (Jansson 1985:202). The fact that the material under discussion is almost entirely fragmentary indicates that this was material for recycling. In such circumstances, fragments can circulate for a long time, and are often found in contexts much later than the period of production (cf. Callmer 1984b:72–3). All in all, this means that it is very difficult to determine when the fragments ended up in the ground. With considerable confidence we can specify a date of production for the objects but what is really interesting in this context is when the activities that ended up with the fragments being lost in Kaupang took place. This could have been considerably later than the period of production of the objects.

The majority of the pieces discussed here were not found in dated contexts: most of them were found by metal-detecting the plough-layer. A few objects are from closed contexts or deposits. One punch-decorated lead strip, possibly an armring, is from the first phase, the initial seasonal settlement, dated 800–805/10. There is a pin from a layer assigned to the permanent settlement dated 805/10–840.

The earliest object that is typologically datable is the fragmentary Migration-period brooch. This could very well have been a piece of ancient scrap metal intended for melting down. However a number of coins with strikingly early dates have also been found in Kaupang. There are two Roman bronze coins of the 4th century and a Merovingian gold tremissis of the 650s (Blackburn 2005a:141, 2008:29–30). Blackburn believes that the Roman coins would have been lost on the site during the Viking Period. In the case of the Merovingian coin, he suggests that it derives from a landing place belonging to Huseby and its hall, which was a high-status centre as early as the 7th century. The Roman coins could have been brought in from Britain, the Netherlands or France, where such coins are common. This could have been metal for recycling, but an intriguing question, of course, is whether they could have been used as currency (Blackburn 2005a:141, 2005b, 2008:69).

The fragmentary Migration-period brooch was found out of any datable context. The question must be considered of whether this, like the tremissis, could be thought to have been lost long before the Viking Period or whether it has to be explained as scrap metal, and thus as evidence of how long material could remain in circulation for such a purpose.

3.5 The recycling of metal

The items of both copper alloy and of silver are for the most part fragmentary. All of the silver pieces except the Thor's hammer are fragmented, as are a good 80% of the copper-alloy items. The corroded break-surfaces render it difficult to determine whether an object was broken or cut up. In many cases, however, it can be seen that the break is slanting as if the object had been cut into pieces. The majority of the fragments, 70%, are also quite small: around 30 mm or less. In other cases it has been possible to determine that objects of copper alloy were deliberately broken up and had been heated up in order to make it easier to dismember them (Kresten et al. 2001:69). Metallurgical examination will not determine whether or not that was the situation with the items discussed here. The size of the fragments may point to deliberate breaking up, in order, for instance, to fit the pieces into a crucible to melt them down.

The recycling of metal items is a familiar feature of craft history, related to political and economic changes on the Continent. When the Western Empire dissolved, the extraction of metals and mining came to an almost complete halt. Amongst copper alloys, analyses reveal a clear and abrupt change in the types of alloy in objects produced in the succeeding centuries. The choice of alloys, especially for small castings, seems extremely random. The reason was probably the absence of any new production of metal which compelled the constant melting down of old objects. From a database of 12,000 analyses, Jouttijärvi has shown how pure tin/copper and zinc/copper alloys became rare in the centuries immediately after the Roman Iron Age. Instead, the objects analysed show a high level of admixture of these alloys, which must imply the regular recycling of metal (Jouttijärvi 2002:37). On the Continent, scrap metal was recovered from abandoned buildings and graves on a large scale. The recycling of metal is also revealed by analyses that show that the material in, for instance, a pair of brooches can vary significantly (Roth 1986:50–2; Aufleger 1996:618). Scrap metal played a crucial role for Merovingian craftsmen. It is believed that newly mined copper was not used even for really major works, such as the bronze doors of the Pfalzkapelle in Aachen (Roth 1986:75).

The same phenomenon is seen in Scandinavia. Metal-detecting at Gudme has produced a large collection of Roman bronzes, including pieces of statues (Vang Petersen 1994:31 and 35–6). These were manifestly imported in a fragmentary state. Callmer provides a series of examples of Roman scrap metal from Scandinavian sites. The bronzes are often found in later contexts, indicating that Roman bronzes were used as raw material for metalworking in northern Europe up to the 8th century (Callmer

Inventory no.	Object	Material	Fieldwork	Date	Figure
C52519/16453	Brooch with rhomboidal foot	Copper alloy	MRE	400–550	3.3
C52516/4095	Equal-armed brooch	Copper alloy	CRM	750–850?	3.4, 3.12
C52517/254	Equal-armed brooch	Copper alloy	Field survey	750–850?	3.5, 3.12
C52517/2050	Equal-armed brooch, Ljønes type	Copper alloy	Field survey	800–850	3.6, 3.12
C52516/3880	Equal-armed brooch, Ljønes type	Copper alloy	CRM	800–850	3.7, 3.12
C52517/2089	Equal-armed brooch, Ljønes type	Copper alloy	Field survey	800–850	3.8, 3.12
C52517/926	Equal-armed brooch	Copper alloy	Field survey	800–850	3.9, 3.12
C52517/779	Model quadruped animal, part of a brooch	Copper alloy	Field survey	850–925	3.10, 3.12
C52517/2531	Brooch-knob	Copper alloy	Field survey	850–925	3.11, 3.12
C52517/1459	Trefoil brooch	Copper alloy	Field survey	800–900	3.13, 3.15
C52516/4101	Trefoil brooch	Copper alloy	CRM	850–900	3.14, 3.15
C52519/15574	Round brooch, Jelling Style?	Copper alloy	CRM	900–1000	3.16, 3.20
C52517/2071	Round brooch	Copper alloy	Field survey	900–1000?	3.17, 3.20
C52517/957	Round brooch	Copper alloy	Field survey	900–1000?	3.18, 3.20
C52519/14009	Round brooch	Copper alloy	CRM	?	3.20
C52517/2092	Round/oval brooch	Copper alloy	Field survey	?	3.19, 3.20
C52517/116	Brooch	Copper alloy	Field survey	?	3.21
C52517/2458	Thor's hammer	Silver	Field survey	?	3.22, 3.24
C52519/15915	Pendant	Copper alloy	MRE	900–1000	3.23, 3.24
C52517/950	Fragment, zoomorphic decoration	Silver	Field survey	800–900	3.25, 3.27
C52519/14294	Decorative knob	Copper alloy	MRE	750–900	3.26, 3.27
C52517/1979	Armring	Copper alloy	Field survey	800–1000	3.28.1
C52517/194	Armring	Silver	Field survey	800–950	3.28.2
C52519/14058	Armring	Silver	MRE	800–950	3.28.4
C52517/207	Armring	Silver	Field survey	800–900	3.28.5
C52517/792	Armring	Silver	Field survey	800–900	3.28.6
C52517/971	Armring	Silver	Field survey	800–900	3.28.7
C52517/622	Armring	Silver	Field survey	800–900	3.28.8
C52517/880	Armring	Silver	Field survey	800–950	3.28.3
C52517/2120	Armring	Silver	Field survey	800–900	3.28.9
C52517/2191	Armring	Silver	Field survey	800–900	3.28.10
C52517/2739	Armring	Silver	Field survey	800–900	3.28.11
C52517/2054	Armring	Silver	Field survey	800–1000	3.28.12
C52517/1954	Neck- or armring	Silver	Field survey	800–1000	3.28.13
C52517/2151	Neck- or armring	Silver	Field survey	800–1000	3.28.14
C52519/14955	Punchmarked rod	Silver	MRE	800–900	3.28.15
C52519/15036	Punchmarked rod	Silver	MRE	800–900	3.28.16
C52519/15562	Punchmarked rod	Silver	MRE	800–900	3.28.17
C52517/408	Spiral-striated rod	Silver	Field survey	800–900	vol. 2, 5.10
C52517/466	Spiral-striated rod	Silver	Field survey	800–900	
C52517/469	Spiral-striated rod	Silver	Field survey	800–900	vol. 2, 5.10
C52517/998	Spiral-striated rod	Silver	Field survey	800–900	
C525517/1088	Spiral-striated rod	Silver	Field survey	800–900	vol. 2, 5.10
C52517/2442	Spiral-striated rod	Silver	Field survey	800–900	
C52519/14893	Spiral-striated rod	Silver	MRE	800–900	vol. 2, 5.10
C52519/14913	Spiral-striated rod	Silver	MRE	800–900	
C52519/15819	Spiral-striated rod	Silver	MRE	800–900	
C52519/17264	Spiral-striated rod	Silver	MRE	800–900	vol. 2, 5.10
C52517/718	Pin	Copper alloy	Field survey	800–950	3.29
C52519/20381	Pin	Copper alloy	MRE	800–850	3.30
C52519/14961	Mount	Copper alloy	MRE	900–950	3.31
C52519/15943	Mount	Copper alloy	MRE	900–950	3.32
C52517/724	Mount	Copper alloy	Field survey	900–1000	3.33
C52519/15694	Mount	Copper alloy	MRE	900–1000	3.34
C52519/14926	Mount	Copper alloy	MRE	900–950?	3.35

Table 3.2 *Catalogue of Scandinavian metalwork found at Kaupang 1998–2003.*

1984b:72–3). Ilkjær (1993:115–16) notes that scrap metal is also included in the deposits in the votive bogs, and believes that its importation may have been at a much greater level than we realise.

Around the year 800 or during the 9th century, Europe stabilized sufficiently for mining and the like to carry on in a more regular manner. Analyses of metal objects from the Viking Period reveal a high proportion of primary alloys – bronze or brass – rather than, as previously, mixtures of the two. This can be interpreted as meaning that in the Viking Period access to imported metals was again good (Jouttijärvi 2002:39; Kresten et al. 2001:5). The analyses of the finds from Uppåkra show this change very clearly (Kresten et al. 2001:67).

It is clear from the studies noted above that the recycling of copper alloys was primarily a feature of the centuries preceding the Viking Period. The fragments of jewellery and the like of Viking-period types that have been found in the settlement layers of central places in southern Scandinavian seem, however, to derive from objects that were treated in the same way as those of earlier periods. It is therefore logical to conclude that these too, or at least some of them, comprise fragments prepared for melting down. The fragments from Kaupang appear no different from their counterparts at other sites. It is thus probable that some degree of production based upon recycled metal continued to be a feature of the Viking Period, particularly its early phase.

One problem, that has been noted above, is that recycled material can be old when it is deposited, abandoned, or in whatever way taken out of circulation. In the sections above an attempt was made to survey the stylistic and typological dates of the objects. This reveals their probable period of production. Their dates of use and deposition are another matter, but since the objects are not, in most cases, from datable contexts, it is not possible to estimate the span between production and deposition.

A majority of the objects that could be dated proved to derive from the transition between the Merovingian Period and the Viking Period (c. 800) and the early 9th century. They comprise fragments of brooches, pendants and mounts of common Scandinavian forms, and often reveal connexions with southern Scandinavia. A close relationship between southern and western Scandinavia has already been demonstrated at this date. Callmer has shown how clear this is in the distribution of particular types of jewellery in Denmark, southern Sweden and Norway (1984a:68). In the case of some types of jewellery it was also possible to show that the material in the graves around Kaupang was rather different from the types found in the settlement deposits. This reinforces the impression that some of the settlement finds reflect a mass of fragmentary and worn jewellery that was circulating as metal for recycling over a wide area. The objects from Kaupang that could be dated to the transition to the Viking Period and its earliest phase, including the relatively large collection of equal-armed brooches and one fragment of a trefoil brooch, fit well into such a scenario. Lead models of types related to the fragments of jewellery strengthen our perception of craft activity in Kaupang, particularly during the 9th century (Pedersen, in prep.).

The finds from the late 9th century and the beginning of the 10th present a more random appearance. They are fewer: one round brooch, part of a trefoil brooch, and two haphazard pieces in the form of a quadruped animal and a knob that had been attached to a brooch, and a cruciform mount. The fragments of later types of oval brooch that one might have expected are entirely absent. This may show that metalworking based on the recycling of metal objects was less significant after 900. It could also be explained by changes in the character of the settlement, or in the accumulation of the stratified deposits (Skre 2007:468). But it could also be due to better access to the primary metals gradually rendering the recycling of scrap metal superfluous.

Chronologically on their own are the two fragmentary trefoil mounts dated stylistically to just before or around the middle of the 10th century. These lack parallels in Scandinavia but belong to a North Sea and North Atlantic zone. In this respect they agree nicely with what was deposited in the graves. Imported finds there reveal that objects from the south became rare after the year 900 while finds from Britain and Ireland retain their frequency (Blindheim et al. 1999:148; Stylegar 2007:84). The two trefoil mounts, both of which were found in the modern plough-layer at the site of Kaupang, are thus entirely congruent with the picture the burials reveal.

3.6 Summary

Both in typological and in chronological terms, the collection of brooches, pendants and mounts of Scandinavian origin presents a quite diverse picture. With a few exceptions, such as the equal-armed brooches, there are no substantial clusters in the material which might support specific conclusions. A particular difficulty is posed by the fact that many of the objects, especially those of copper alloy, are severely corroded and so hard to classify precisely. The result of this examination is therefore primarily to demonstrate some possibilities rather than to trace definite contours. The various groups of finds are so small in themselves that any further identifiable fragment could change the picture. The suggestions that are discussed here thus need to be assessed along with the total perspective in respect of small finds from Kaupang. Most of the Scandinavian jewellery and mounts from the stratified deposits and plough-layer at Kaupang are fragmented. This is definitely attributable to the fact that this is material for recycling with a view to the production of new jewellery.

The jewellery and mounts from Kaupang are of familiar Scandinavian forms, with parallels in the graves at Birka and Hedeby, and in settlement finds from southern Scandinavia in particular. One group of objects has a distinct association with southern Scandinavia and a Continental source, while there are also individual objects that rather point to a connexion with Britain and Ireland, the North Sea region or the North Atlantic.

The datings are based upon comparisons with similar objects over the whole area of southern Scandinavia, Norway and central Sweden: especially grave-assemblages. However fashions need not have changed at the same pace all over this huge area. The dating of cast copper-alloy objects is also difficult because items could have been copied long after the original model was manufactured (Jansson 1985:12). This means that the datings proposed are naturally encompassed by a degree of uncertainty. It is also important to bear in mind that the datings are for the production of the objects. The activities that led to their loss or deposition could have taken place much later.

The datings of the Scandinavian decorated material from Kaupang run from the late 8th century across the 9th century and some way into the 10th, with a definite centre of gravity in the very early Viking Period (Fig. 3.36, Tab. 3.2). Some objects are from the periods that preceded the Viking Period. These can probably be explained as scrap metal that remained in circulation for a long time.

The two equal-armed brooches that have tentatively been dated to the late 8th century have associations in southern Scandinavia, perhaps with influences from rectangular brooches on the Continent. The brooches of the 9th and 10th centuries generally have parallels over a wide range within Scandinavia. These are types of a more or less common character, widely distributed and probably also produced in various regions. Lead models corresponding to well-known brooch-types render it likely that at least some types of equal-armed brooch were produced in Kaupang (Pedersen, in prep.). Since these are early types of jewellery, it is reasonable to conclude that this production was linked to the early phase of Kaupang's functioning life.

The link with Britain and Ireland may be represented by one fragment of a silver armring, although this form is also clearly associated with Denmark in the Early Viking Period. A clear North Sea and North Atlantic connexion is, however, made manifest in the two fragmentary trefoil mounts that are to be dated to the mid-10th century.

Figure 3.36 *Chronological chart of Scandinavian metalwork found at Kaupang 1998–2003. Four undated objects and the Migration Period brooch C52519/16453 are left out. Less certain dates are indicated i orange.*

Number	Object	750	800	850	900	950	1000
C52516/4095	Equal-armed brooch						
C52517/254	Equal-armed brooch						
C52519/14294	Decorative knob						
C52519/20381	Pin						
C52517/926	Equal-armed brooch						
C52517/2050	Equal-armed brooch/Ljønes type						
C52516/3880	Equal-armed brooch/Ljønes type						
C52517/2089	Equal-armed brooch/Ljønes type						
C52517/1459	Trefoil brooch						
C52517/950	Fragment, zoomorphic decoration						
C52517/207	Armring						
C52517/792	Armring						
C52517/971	Armring						
C52517/622	Armring						
C52517/2120	Armring						
C52517/2191	Armring						
C52517/2739	Armring						
C52519/14955	Punchmarked rod						
C52519/15036	Punchmarked rod						
C52519/15562	Punchmarked rod						
C52517/408	Spiral-striated rod						
C52517/466	Spiral-striated rod						
C52517/469	Spiral-striated rod						
C52517/998	Spiral-striated rod						
C525517/1088	Spiral-striated rod						
C52517/2442	Spiral-striated rod						
C52519/14893	Spiral-striated rod						
C52519/14913	Spiral-striated rod						
C52519/15819	Spiral-striated rod						
C52519/17264	Spiral-striated rod						
C52517/194	Armring						
C52519/14058	Armring						
C52517/880	Armring						
C52517/718	Pin						
C52517/1979	Armring						
C52517/2054	Armring						
C52517/1954	Neck- or armring						
C52517/2151	Neck- or armring						
C52516/4101	Trefoil brooch						
C52517/779	Model quadruped animal						
C52517/2531	Brooch-knob						
C52519/14961	Mount						
C52519/15943	Mount						
C52519/14926	Mount						
C52519/15574	Round brooch, Jelling Style?						
C52517/2071	Round brooch						
C52517/957	Round brooch						
C52519/15915	Pendant						
C52517/724	Mount						
C52519/15694	Mount						

Continental and Insular Metalwork 4

EGON WAMERS

Eleven pieces of Continental and ten of Insular ornamental metalwork found during the excavations and surveys at Kaupang and Huseby have been examined with regard to their provenance, date, function and culture-historical implications. Particular attention has been paid to the question of their sometime role within the trading site of Kaupang, and to what they can tell us about the character of the site.

One additional object from Kaupang could not be attributed with absolute certainty to the sphere of Insular art. The eleven Continental objects consisted of items of male armament and riding equipment and female jewellery of the late 8th and 9th centuries, with one piece (Huseby) probably from some ecclesiastical item. Most of them could be attributed to the area of northern France and Frisia. In the case of the most precious piece, a gilt silver sword-belt mount, and for the mount-fragment from Huseby, an art-historical source in the area of southern Germany or northern Alps, or East Frankia in general, can be identified. These finds, which are predominantly to be classified as casual losses, are good evidence for the presence of Franks and Frisians, both male and female, in 9th-century Kaupang.

The ten or eleven Insular objects from the settlement of Kaupang are highly fragmentary, and derive from both ecclesiastical and secular (costume) pieces. In some cases there is evidence of the secondary re-working of the objects into brooches. These objects belong exclusively to the Irish, or at most the "Hiberno-Saxon" type-corpus, and no distinctly Anglo-Saxon product is present. Given the poor scope for dating Insular art in comparison with Continental metalwork, it is possible in only one case to date these more closely than to the 8th and 9th, or mid-8th to 9th, centuries. There is, however, no Insular object that cannot date from the 9th century. The Insular ornamental metalwork does not constitute evidence for the presence of people from Ireland or Britain in Kaupang, except, probably, for the lead model discussed elsewhere by Pedersen (in prep.). Rather, the relative frequency of Insular metalwork (with which we must count the ring brooches and the earlier finds) is to be associated with Kaupang's role as an international trading site. Charlotte Blindheim's much repeated idea of an intensive secondary trade in ornamental Insular metalwork in Scandinavia seems to be supported by the evidence of trading sites such as Kaupang at least. The buckle from Huseby suggests a direct, personal relationship between the sometime lord of that place and the Insular West.

The distribution of the Continental and Insular metal small finds in the excavated area allows one to speculate on a division of the space between people from different areas. At least one Continental plot/house can be seen in the evidence of the lost dress-accessories.

Amongst the more than 30,000 small finds from the archaeological investigations at Kaupang and Huseby in the years 1998–2003 are some three dozen pieces of ornamental metalwork from either the Continental Frankish realm or the Insular zone of Britain and Ireland. From this group, the annular (ring) brooches and the decorated lead castings will be discussed separately (Graham-Campbell, this vol. Ch. 5; Pedersen, in prep.). Besides the remaining 22 objects, however, the earlier excavations in the settlement and cemeteries of Kaupang had produced a similar quantity of imported metal artefacts. These have been the subject of lively scholarly discussion already (see below). As will be shown in this chapter, the Continental objects comprise Carolingian-period dress-accessories and pieces of Frankish weaponry and equestrian fittings. The Insular material, on the other hand, consists principally of fragments of incomplete major Irish or Hiberno-Saxon metal artefacts that had been removed from their original functional context in Kaupang: the exceptions are the annular brooches, and a buckle from Huseby (Fig. 4.22.1). These differences need to be assessed and interpreted in greater detail using archaeological methods.

Although a great quantity of decorated Continental and Insular metalwork is known from Scandinavia, the new finds are of special significance. For one thing, as foreign objects that can be identified in precise chronological and typological terms, they provide concrete information about the character of the international trading site of Kaupang and its international connexions. Furthermore, they may – to some degree at least – be taken as evidence for the presence of foreigners (merchants?) in Kaupang, rather than being regarded solely as trade goods (Skre, this vol. Chs. 15:411, 16:421–2, 431–4, 17:446–7). Last but not least, they support new conclusions concerning the significance and function of Continental and Insular metal ornaments in Scandinavia.

In what follows, I shall describe the individual pieces, grouped according to their Continental or Insular provenance, and discuss them in detail. A general assessment is then given, paying particular attention to the relevance of this material to our understanding of the site of Kaupang.

4.1 Continental metalwork

4.1.1 The finds from Kaupang 1998–2002

Sword-belt mount

C52517/274 (Fig. 4.1) Heavy cast silver with mercury gilding and niello inlay added after gilding. The oblong mount has a shaped outline. Half of the mount is flat when viewed from the side, the other half dominated by a hollow, hemispherical boss surrounded by three half-formed shooting buds and four round and pierced rivet-lugs. In one of these lugs there is still a silver rivet with a low domed head, the shank of which is bent on the underside. The other rivet-holes are empty. At the other end of the mount there is a larger, irregularly rounded lobe for a rivet with cuts or breaks on one side; here the remains of both an upper and lower sheet of foil are held in place by a rivet hammered flat from on top. The boss shows signs of wear, especially towards the point. The underside, which is flat except for the hollow boss, shows no signs of working up after casting; alongside the central rivet-holes one or more faint slanting lines or thin folds can be seen. No secondary re-use as a brooch or mount can be identified. Max. length 41 mm; max. width 26 mm; thickness of the mount 2 mm; height including boss 8 mm; weight 11.5 g.

Figure 4.1 *Carolingian sword-belt mount from Kaupang (C52517/274). Cast silver with mercury gilding and niello inlay. Photo, Eirik Irgens Johnsen, KHM. Drawing (scale 1:1) Bjørn-Håkon Eketuft Rygh.*

Figure 4.2 *Comparanda to the sword-belt mount (C52517/274) in Fig. 4.1.* ***1.*** *British Museum, London;* ***2.*** *Biskupija-Crkvina, Church of Mary;* ***3.*** *Kunsthistorisches Museum, Vienna;* ***4.*** *Trebur;* ***5.*** *Weltwitz;* ***6.*** *Dorestad;* ***7.*** *Duesminde;* ***8.*** *Kolín. (Scale 1:1).*

The decoration consists alternately of fields of engraved decoration and plane surfaces inlaid with niello. The three half-modelled shooting buds introduce floral chip-carved decoration outlined with niello in such a way as to allow the buds to be read as animal heads. The flat plate has a roughly kite-shaped field with extended, part-curving arms in which four drop-shaped nielloed motifs have been inserted. The remaining longitudinal and round border fields carry tendrils in deep chip-carving: two with a quatrefoil- and two with an S-shaped volute, one of which also has a small arm to one side. The boss has six roughly triangular ornamental fields, which alternately carry deep chip-carved tendrils, each with three volutes, and flat, nielloed trefoils.

In its motifs and in style, the decoration belongs to the range of the later Tassilo Chalice Style of the late 8th and early 9th centuries. Here, the Tassilo Chalice Style is not taken only to mean the "Insular animal style of Continental character" (Werner 1959) but rather the whole style group that is found on the eponymous Tassilo chalice and on other major church treasures (Wamers 1999:201–15). Admittedly, the Kaupang mount lacks animal ornament, although the tendrils with rolled ends have parallels – as individual tendrils, or as the terminals of zoomorphic body parts – on the mounts from Oldenburg, Donzdorf (Gabriel 1988:figs. 6.1–2) and Zellingen (Wamser 1991:fig. 29b), the Old Lindau book-cover (Haseloff 1980:pl. 37), Mayen or Mainz (Wamers 1993:figs. 4.6 and 4.5b). Especially close parallels to the tendrils appear on two strap-ends with knobbed terminals of unknown provenance in the British Museum and the Kunsthistorisches Museum, Vienna (Figs. 4.2.1, 4.3; Wamers 1993: fig. 4.5d; Daim 2000:177–82 and figs. 104a–b). While the example in London has a swastika-shaped ten-

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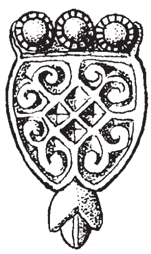

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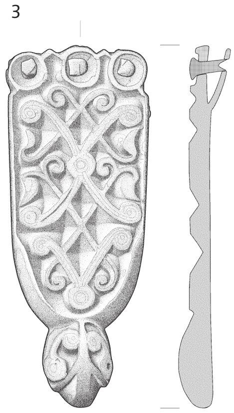

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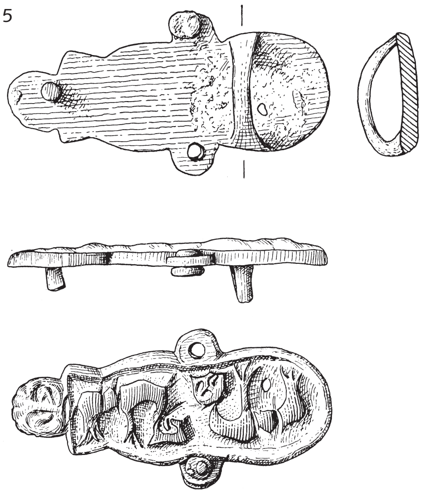

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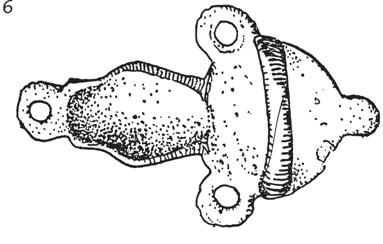

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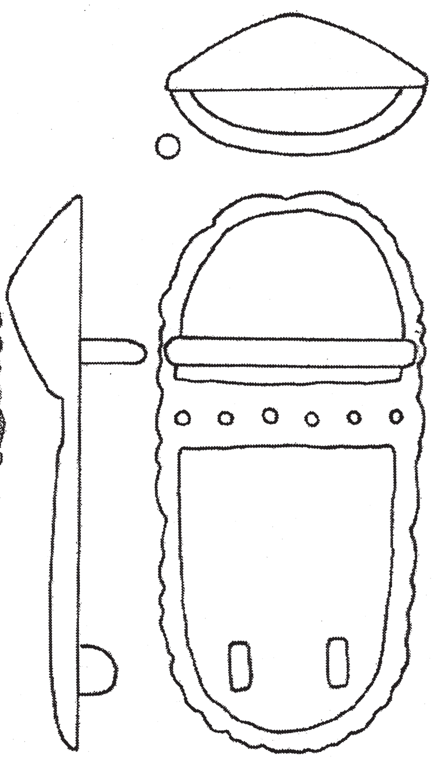

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dril, like the strap-end from Kaupang, the strap-end in Vienna – which came in fact from a London art dealer – is a specimen of high-quality bronzecasting with silver inlay and gilding (length 48 mm; max. width 23 mm) and provides an immediate prototype for the "westliche Stäbchenranke" of the decades around the year 800. These partially symmetrical, network-forming tendrils usually have dotted or circular knots on the crossing points and intersections, varying the motif of the rolled-up terminals. As Falko Daim has pointed out, these "Stäbchenranken" must have been adopted from Byzantine ornamental metalwork of the 8th century. In late Avar and West Slavonic metalworking they play quite a predominant role (Daim 2000). Small leaf terminals show that these are vine or ivy scrolls. Such volutes are likewise found in chip-carving on the Carolingian spur-sets from Biskupija-Crkvina, which also have the form of the cross (Fig. 4.2.2; Vinski 1983:figs. 18–19). These decorated objects can be dated to the late 8th or the early 9th century (Wamers 1994c:9–10).

Quatrefoils formed of drop-shaped or circular motifs inlaid with niello in plane surfaces, producing rosettes or general plant patterns, are also frequent in the wider orbit of the Tassilo Chalice Style. A good example of this is the mount from Trebur (Fig. 4.2.4). Trefoil knots or loops remained in vogue throughout the 8th to 10th centuries; with continuous internal lines they are also found on the Tassilo chalice itself from c. AD 777 (at the transition between the *nodus* and the foot), on the underside of the guard of sword Bb from the boat chamber grave at Hedeby, from the first third of the 9th century (Wamers 1994c:figs. 6 and 8), on the portable altar from Adelhausen (Haseloff 1978:fig. 12), and on the equal-armed brooches from Camon (Périn and Feffer 1985:col. pl. 150) and Muysen (Arbman 1937:fig. 30) – all from the middle decades of the 9th century.

In the case of the semi-formed shoots it is difficult to determine whether these are floral or zoomorphic – in other words whether they represent buds or animal heads, as the niello inlays can be read as resembling the pupils of eyes. Since, however, none of the knob terminals of the "bird-shaped" – which, to be strict, ought to be described as "leaf-shaped" – and U-shaped strap-ends from the second half of the 8th and first half of the 9th centuries are unambiguously formed as animal-heads, but are very frequently clearly buds (e.g. Giesler 1974:figs. 1 and 3; Vinski 1983:figs. 10, 13 and 18–19; Figs. 4.2.1–3), the projections on the Kaupang mount should also be bud ends, which artistically agrees well with the tendrils. This conclusion is supported by the strap-end from Vienna (Fig. 4.2.3) where, again, tendrils are modelled on the bud ends. In the combination of bud ends with volutes the strap-ends of the spur-gear from the sarcophagus in the Church of Mary in Biskupija-Crkvina in Dalmatia offer another close parallel (Fig. 4.2.2).

For the combination of chip-carved decoration in relief and plane nielloed surfaces found on the Kaupang mount, there are also good parallels in the metalwork of the second half of the 8th and first half of the 9th centuries. The most prominent example of this combination is the Tassilo chalice itself: smooth plane surfaces with figural motifs and letters in niello contrast with corrugated fields of chip-carving (Haseloff 1951:pls. 1–8). The pyx from Fejø and the thurible from Cetina (Wamers 2005a:fig. 31 and cat. no. 29) confirm the fact that this form of style was a fundamental feature of exceptional craftmanship in the Tassilo Chalice Style and related artwork. As a further parallel, we could cite the rivet-plates on the spurs from grave 4 at Biskupija-Crkvina and the already mentioned mount from Trebur (Fig. 4.2.4; Vinski 1983:fig. 18).

In functional terms, this mount from Trebur is in fact the closest counterpart to the mount from Kaupang: a long, bipartite mount for fastening the sword-belt to the scabbard with three or more loops on one of the narrow sides in a radial pattern and further loops on the other narrow side. Mounts of this type and of similar form were typical Carolingian sword-fittings. Pictorial representations from manuscripts of the 9th century show that the wooden scabbards were fastened with two mounts to the belt around the waist. The belt itself crossed the top of the scabbard at a right angle and was fixed to it by a long mount (the "main mount"); a second strap, which was attached to the main belt, was fixed to the scabbard a bit further down in order to hold the sword at a slight angle (Menghin 1973:fig. 45; Wamers 2005a:52–5, figs. 8–11 and 17–19). The Kaupang mount is one of these "secondary mounts", just like those from Trebur, Dorestad (Roes 1965:22, fig. 13 and pl. IV:35) and Weltwitz (Neumann 1964: fig. 4; Wamers 1999:fig. 20; Figs. 4.2.4–6), and probably also the fragment from Duesminde (Wamers 2005a:130, cat. no. 36a.1). As mounts of the 9th century both with and without acanthus decoration we can certainly count those from "Paris", Claughton Hall, Biskupija-Crkvina grave 6, Koljane-Crkvina, Slemmedal, Duesminde, Kolín and Marsum (in each case the long oval or rectangular mounts: Wamers 1981:figs. 11.1–2; Vinski 1983:figs. 11.5 and 12.6; Blindheim 1981:figs. 15–16; Wamers 2005a:cat. nos. 36b1–2; Lutovský 1994:fig. 3.1l; Knol in Wamers 2005a:121 with fig., lower; Figs. 4.2.5–8). Instead of rivet-holes, several of these have cast loops on the underside through which the secondary strap was drawn, which also allowed for greater movement of the secondary strap and thus less load on the mount: see, for example, Weltwitz (Fig. 4.2.5), Dorestad (Fig. 4.2.6), Duesminde sets 1 and 2 (Fig. 4.2.7), Marsum, Biskupija-Crkvina grave 6, Koljane-Crkvina, Kolín

(Fig. 4.2.8), and the fragment from Stará Kouřim (Šolle 1966:fig.11a.hr 55–3c). Others indeed, sometimes in connexion with the loop, have a raised boss, thus providing more space for the strap on the underside. The mounts from Kaupang, Duesminde and Kolín are of this type.

Altogether, we can be confident that the mount from Kaupang had been part of the sword-harness of a high-ranking Frankish man from the period c. AD 780–820, probably from the decades following 800. It was evidently fastened to the thin scabbard by the bossed half between the four loops and the belt, where indeed a plain, bent-over rivet is preserved. Since the scabbards were made of thin slices of wood, fixing with several rivets was essential. It is not possible to determine whether the visible line immediately behind the rivet-holes on the underside of the plane part of the mount is an impression of the scabbard itself, up to the point at which the mount was fastened to it, or is rather the impression of the formerly larger lower appliqué, of which now only a fragment survives beneath the end of the rivet.

This item has not secondarily been reworked as most Frankish sword-mounts in Scandinavia have. The boss and the end of the rivet give the impression of having been worn for a lengthy time. Accidental loss, from the breaking of the sword-hangings, is hardly plausible in view of the large number of fastening points (five in all) on the mount. It is, therefore, credible that this was an old object that retained only the value of its material and was probably meant to be melted down for recycling.

On the Continent, objects decorated in the Tassilo Chalice Style are found mostly in the eastern part of the Carolingian Empire, with only a few examples found in what now are France and Poland, but a rather creditable quantity in northern Italy and Dalmatia. In Scandinavia, we have a few finds from Denmark and Birka, together with one mount from a sword-belt from Møre og Romsdal (Wamers 1994a:fig. 21; Schulze-Dörrlamm 1998:fig. 2): distinctly fewer than items with acanthus ornament of the Carolingian "Renovatio" (Fig. 4.4). This is congruent with their chronological place in the period before 800, because the various contacts with Scandinavia were then considerably less intensive than in the 9th century. As a rule, these finds would have been old objects such as a few re-used fragments from the Saxon lands (Maschen, Münster, Paderborn-Wewer: Wamers 1994a:35; B. Thier in Isenberg and Rommé 2005:221), that had reached the North in one way or another.

There are several possible explanations for how this piece came to Kaupang. It may have been brought to Kaupang by a Frank as part of his armament at the end of the 8th century or early 9th century, and then disposed of, probably because it was no longer smart or modern. On account of its valuable material – gilt and nielloed silver – and because the Frank owner was a sword-bearer, we should regard him as high-ranking. Other explanations might be that the object was purchased by a tradesman or fine-metalworker as a piece of silver scrap at some market, either on the Continent or in Scandinavia, or brought to the North by a far-travelled trader. Components of Frankish weaponry and horse-harness with Tassilo Chalice-style decoration are, in Scandinavian contexts, normally found – in some secondary re-use – only from the first half or beyond the middle of the 9th century (Wamers 1994a:33). However, as far as we can tell, precious sword-fittings such as these were not themselves the objects of trade.

Fragment of a strap-end

C52517/1496 (Fig. 4.3) A heavy copper-alloy casting, originally completely covered with silver foil; remains of niello(?) and probably of mercury gilding in the recesses (?) on the face. On the edges only fragments of the silver foil remain. Almost U-shaped with a slightly bowed profile. On the blunt end, traces of a projection can be made out, possibly a rivet plate. The underside is flat except for a rectangular sunken area at the blunt end which was probably left here by some pressure and thus would be secondary. Max. length 27 mm; max. width 19 mm; thickness of the mount 3.5 mm; weight 7.9 g.

On the upper side there are four pits in the bundles of acanthus leaves, passing through the silver foil to the copper-alloy core of the object, one of which is recognizably rectangular and another triangular; the other two are distorted, but were originally also rectangular and triangular respectively. These may have been settings for inlays, most probably of glass.

The decoration of the face consists of two confronted acanthus palmettes. A larger one runs with Y-shaped branches and side-leaves out from the baseline and opens out into – not quite complete – leafage. The other begins in the point with a palmette, over which stands a curved pair of volute-shaped branches with small, three-leaved points.

It is most likely that this is a fragment of a strap-end. The width of the strap at around 20 mm suggests that it was associated with spurs, a bridle, or a narrow belt. The leafwork with its emphatically modelled, fluted palmettes, in part with curling terminals, links this piece to the strap-end from the hoard of Muysen (Belgium; t.p.q. AD 866), the pyx from Halton Moor (c. 820–830), the sword-fittings from Kolín (Bohemia; first half of the 9th century), and a pendant from the hoard of Duesminde (Denmark: Wamers 2005a:cat. nos. 36–7). In Carolingian manuscript illumination and ivory carving the closest parallels are found in the works

Figure 4.3 *Fragment of a Carolingian strap-end from Kaupang (C52517/1496). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 4.4 *Distribution of Carolingian metalwork in Scandinavia. Large symbols indicate two or more finds. Blue: with acanthus ornament; green: Tassilo-chalice Style. Map, Elise Naumann.*

of the Aachen court school after the year 800: to some degree in the acanthus capitals in the Gospel Book of St Médard de Soissons, and from Lorsch Abbey, on the Chalice of St Lebuinus [see: *Encyclopaedia Britannica*] from Deventer, or on the book cover in the Aachen Cathedral treasury, all from the beginning of the 9th century (Braunfels 1968:figs. 156–62, 148 and 200). Less clearly demonstrable are the similarities with the school of Metz: for instance the Gospel Book in Paris, Bibliothèque Nationale Lat. 9388, of c. 834–843 (Koehler 1960:pls. 68–9). A dating later than the middle of the 9th century must be ruled out; the early 9th century is the earliest conceivable date. It is not possible to determine from which part of the Frankish realm this strap-end emanated; provenances east and west of the Rhine are equally credible.

Unlike most Continental mounts with plant decoration found in Scandinavia, the strap-end from Kaupang is not of solid silver but rather just covered in silver foil. Copper-alloy mounts covered with silver foil or whitemetal and gilt, and with plant decoration, are also known from the Viking burial at Balladoole on the Isle of Man, Hedeby, Birka grave 566 and Duesminde (Bersu and Wilson 1966:36–7, cat. nos. 19–22, pl. 7b–d; Wamers 1981:124 Fundliste 1, fig. 8.2; Arbman 1940–1943:83–4, pl.83.9a–b; Wamers 2005b). They are evidently to be counted generally as of lesser value than the solid silver mounts.

Carolingian mounts with plant decoration have been found in Scandinavia – overwhelmingly in the historical kingdom of Denmark, including the Oslofjord area. There are only a few finds from south-western and western Norway or from eastern Sweden, including Birka (Fig. 4.4). Further off, there are a number of examples from Viking-period contexts in Britain, Ireland and Iceland (Wamers 1991a:146 n.156, fig. 32). Most of these must have come to the North either as plunder or in the form of tribute payments, in the course of the 9th century; others by way of trade or diplomatic contacts. Several of them had seen long secondary re-use in Scandinavia in the form of female dress-accessories, to be hoarded and buried as late as the second half of the 10th century as scrap metal of high value (Wamers 1984:97–101, 2005a:112–18). The fragmentary strap-end from Kaupang has no (surviving) detectable signs of any secondary re-working, but does appear, on the evidence of its fragmentary and worn state to have been an old artefact – even taking the destructive archaeological context in a settlement into account. It must certainly have come into the ground some time after 850, but how much later we cannot tell. We cannot exclude the possibility that it was lost in Kaupang by a Frank resident there (as a tradesman? or a horseman?).

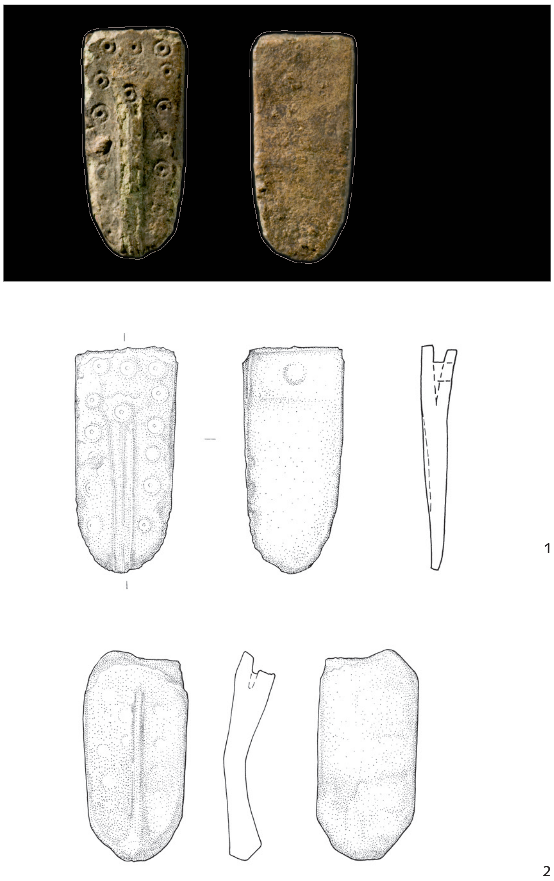


Figure 4.5 *Two Carolingian strap-ends from Kaupang (**1.** C52517/844; **2.** C52517/1724). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Two strap-ends

C52517/844 (Fig. 4.5.1) Bronze (copper-alloy), semi-lanceolate; cast, severely corroded. Notched end for holding a strap of around 12–13 mm width. A rivet protrudes into the opening which – to judge by faint marks on the underside – was hammered in from the underside.

The face has a low mid-rib with flat furrows on either side running some two-thirds of its length, probably chased. Fourteen dot-in-circles are freely but symmetrically distributed over the whole of this surface. Length 31 mm; max. width 13 mm; thickness 4 mm; weight 7.7 g.

C52517/1724 (Fig. 4.5.2) Lead or lead-alloy; cast [?]. U-shaped, with a slight tapering of the lower end. Damaged at the slotted end and corroded on the face. Bent when seen in profile.

The face has a narrow raised mid-rib, to the sides of which an irregular pattern of dots can just be made out. The mount is thicker towards the ends. No traces of oxidized iron or copper alloy from a lost rivet can be detected at the broken slotted end. The underside appears to be undecorated. Length 28.3 mm; max. Width 14.2 mm; thickness in the middle 3.4 mm (5.6 mm at the slotted end); weight 7.9 g.

Both objects are Carolingian strap-ends of the 9th century. Similar strap-ends to C52517/844, albeit mostly with a riveted plate behind for three or four rivets, are known, *inter alia*, from Domburg, Oldenburg and the Bohemian princely grave at Kolín (Figs. 4.6.1–3; Capelle 1976:no. 307; Gabriel 1988:fig. 5.4; Lutovský 1994:figs. 5.1–2 and pl. 4.5). The strap-end from Carlisle Cathedral (Cumbria), together with a matching buckle and mount, also belongs with this group; it is in any event strongly influenced by the Carolingian models (Fig. 4.6.4; Thomas 2001:figs. 4.4–5). The pair from Kolín are made with gilt silver foil; the five-stranded mid-rib, like the side ridges, consists of filigree wires of varying thickness, and the fields in between are filled with large garnets set in filigree rings. There is analogous decoration on the associated belt-slides and spurs (colour illustrations in Wamers 2005a:172 with figs.). Expensive filigree-decorated strap-mounts of this kind must undoubtedly have been the models for simple bronze castings with punched motifs such as this one from Kaupang. It is noticeable that the mid-ribs are commonly combined with furrows along the sides, probably in imitation of the complicated form of mid-ribs in filigree.

The iron specimen from Karlburg (Fig. 4.6.5) provides a close parallel to the strap-end C52517/1724, including the slotted end, albeit with no dotted decoration. The size implies that this was a buckle for shoes or spur-straps. Lead was a convenient material in the 9th century, commonly used for everyday dress accessories.

Carolingian strap-ends (and others, such as oval belt-mounts) with mid-ribs or -ridges are introductions of the middle third, possibly also the second to third quarters, of the 9th century. They derive ultimately from extravagantly worked specimens with acanthus ornament on which a prominent central trunk forms the decorative field together with leaves to each side. The best example of this has been found at Stentinget in Vendsyssel, Denmark (Wamers 1998a). The strap-ends with filigree and garnet decoration represent a geometrically simplified variant of this. Strap-ends of this kind can also have a rounded, U-shaped terminal, as shown by examples from Karlburg, Unterfranken (Fig. 4.6.5), or from grave 366/49 in Staré Město, Slovakia (Wamers 1992: fig. 25.15; Schulze-Dörrlamm 1993:fig. 32.3). A further variant is formed of strap-ends and -mounts of ridged/roof-shaped cross-section with a prominent mid-ridge, as, for example, the pieces from Ketzendorf near Buxtehude grave 516 (Fig. 4.6.6) or Biskupija-Crkvina grave 88/1950 in Croatia

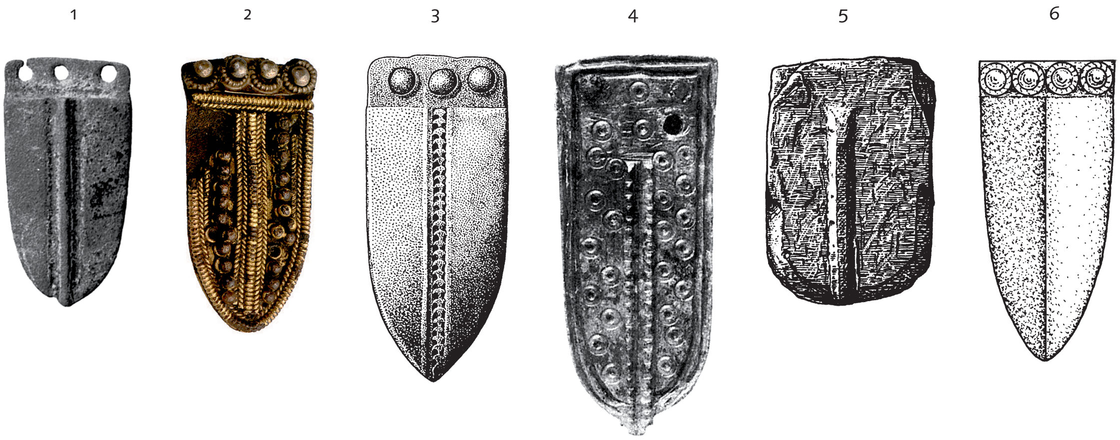


Figure 4.6 *Comparanda to Kaupang strap-ends (C52517/844, /1724).* **1.** *Domburg;* **2.** *Kolín;* **3.** *Oldenburg;* **4.** *Carlisle;* **5.** *Karlburg;* **6.** *Ketzendorf, grave 516. (Scale 1:1).*

(Fig. 4.7.4). The simple copper-alloy and iron specimens belonged to the furnishings of non-noble social classes (e.g. von Freeden 1983:457–60; Wamers 1994a:23, 1998a:523–4). The dating of this group of strap-ends (Fig. 4.6) can be established on the basis of art-historical and formal analysis, and also through grave-associations and coin-dated hoards at Roermund (t.p.q. AD 864: van Gelder 1985:18–19 and fig. p. 21) and Trewhiddle in Cornwall (t.p.q. 875; Wamers 1998a:522–3). The widespread distribution of the finds known so far, from the North Sea coastal regions through the Middle Rhine area to Slovenia, Croatia and central Italy (San Vicenzo al Volturno: Mitchell 1994:fig. 8B) does not support a more precise determination of their area of origin and use than within the (eastern?) Carolingian Empire. Late-Saxon and Anglo-Scandinavian find-contexts of the late 9th and the first half of the 10th centuries contain imitations of these strap-ends with a mid-rib (cf. the models for C52519/19673: Fig. 4.21.1).

The small strap-ends from Kaupang very probably belonged with a set of spurs; possibly, but less probably, with a man's shoes (cf. Gabriel 1988:118–19). As of yet, no comparable small mounts for a woman's stockings or shoes are known from the 9th century. Much less likely would be any association with a small belt, since no such belts have appeared, archaeologically, up to now. With regard to quality, this would not have been associated with a man of high rank. Merovingian-period buckles and mounts from leggings and footwear are frequently found in Early-medieval central places such as Mainz; they can be regarded as casually lost items that remained unnoticed. This is supported by sets of mounts which include pieces (buckles, strap-ends) that have been replaced (Wamers 1994a:49). Since the specimen from Kaupang is neither damaged nor shows any reworking this was probably also lost here by its wearer. Since Carolingian spur-sets are so far unknown in the burials of Scandinavian men of the 9th century, it is highly likely that the men who were wearing the Kaupang strap-ends were Franks or Frisians, so that it also provides evidence of the presence of someone from the Continent of no great status, probably men, at some time in the second or third quarter of the 9th century (820–880).

Two strap-slides

C52517/867 and **/900** (Figs. 4.7.1–2) Cast and beaten; with punched decoration. Manufactured from a cast round or rectangular copper-alloy loop, out of which the oval decorative plate has been beaten out and the bow maybe hammered into a plate of rectangular section.

/867: Fragment. Flat, oval plate, on the ends of which two prongs, of rounded cross-section, are cast in at right angles. These are broken off, but originally formed a rectangular bow with an interior height of about 6 mm. The decorative plate is slightly raised in the centre along the line of the ribbon-shaped bow. This raised rib carries the remains of X-shaped punchmarks; the other oval surfaces have punched filligree dots in circles. Max. length 28 mm; max. width 13 mm; max. height 9 mm; weight 3.3 g.

/900: Flat oval plate with extended ends. The rectangular bow formed by a bar of rounded cross-section is cast in one; it has been pushed over towards one side. Along the line of the bow there is a faintly detectable raising of the plate. Undecorated. Max. length 25 mm; max width 11 mm; max. height 9 mm; weight 2.6 g.

These objects come from two separate sets, but are nonetheless fully consistent with one another in respect of form and production technique. Small belt-slides, usually some 20–30 mm long, are a regu-

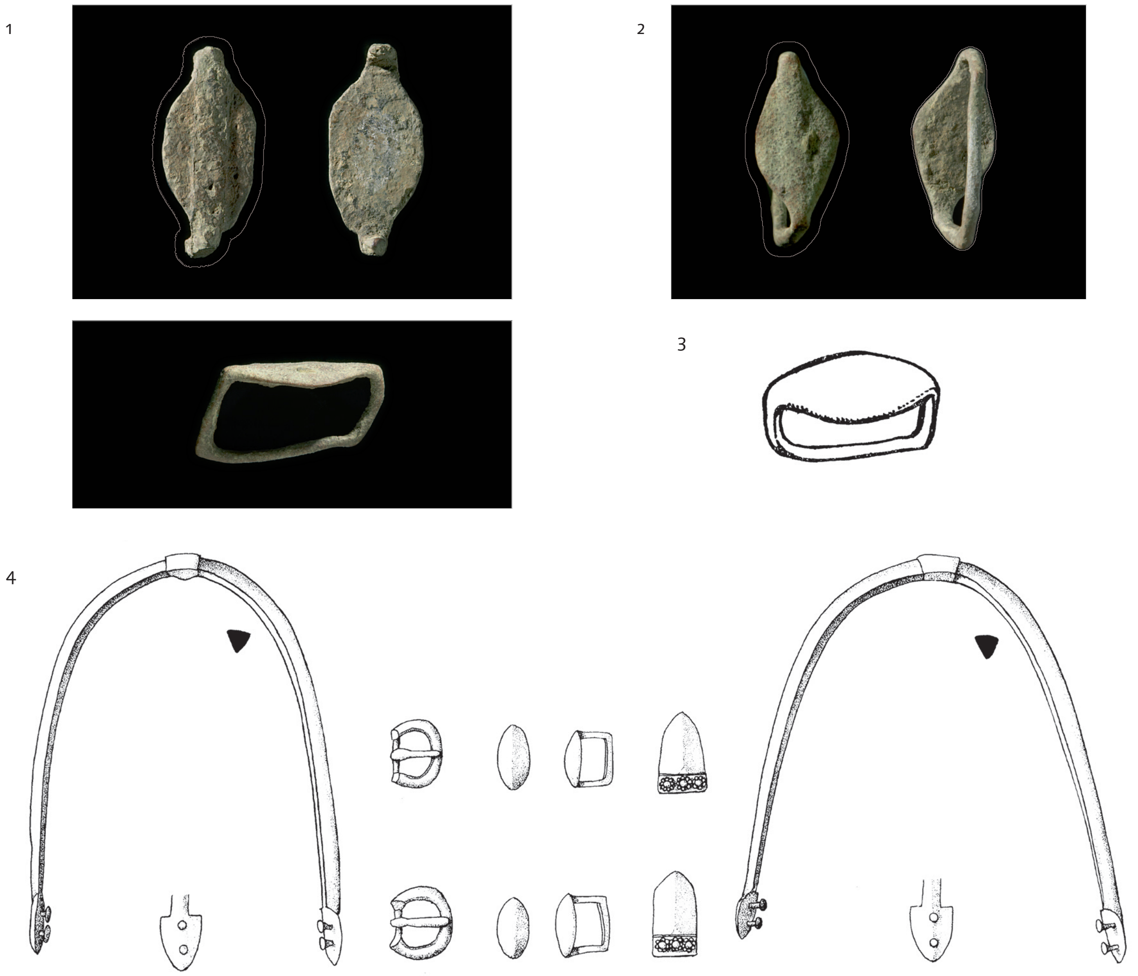


Figure 4.7 *Two Carolingian strap-slides from Kaupang (**1.** C52517/867; **2.** C52517/900). Photo, Eirik Irgens Johnsen, KHM. Comparanda: **3.** Dorestad; **4.** Biskupija-Crkvina, grave 88/1950. (Scale 1:1).*

lar part of the repertoire of Carolingian spur-sets and are normally found in pairs (Fig. 4.7.4; cf. von Freeden 1983:457–63; Thieme 1978–1980:figs. 4.8 and 13; Laux 1978–1980:figs. 1.1–2 and 3.1–2; Vinski 1983:figs. 6.6, 12.10, 17.9 and 12; Wamers 1994a:23, 1998a:523–4). Close parallels in terms of size, form and material are known from Dorestad (Fig. 4.7.3; Roes 1965:19, fig. 8 and pl. IV.26) and grave 60 at Grafendobrach, Oberpfalz (von Freeden 1983:fig. 22.5). These types have not hitherto been observed as the strap-slides associated with any other types of belt or buckle. They may, according to the quality of the set as a whole, be expensively and ostentatiously decorated (e.g. the "Seeheimer Schmuckstück"; the Bohemian princely grave of Kolín; the hoard of Duesminde: Wamers 2005a:cat. nos. 23, 40 and 36c), or simple and poor like the specimens from Kaupang. They are found in various degrees of quality and formal finish over the whole area of the Carolingian Empire and – either as exports or imitations – in the neighbouring territories. In Scandinavia there are simplified imitations in the native style, and a precise determination of the single piece from Birka grave 158, or from a disturbed cremation or a damaged inhumation, is not possible (Arbman 1940–1943:68–9 and pl. 86.16). It is likewise impossible to determine if this is an imported item or a Scandinavian copy. The form with an oval decorative plate, often with a central ridge, belongs primarily to the second and third quarters of the 9th century (cf. von Freeden 1983:457–60; Wamers 1994a:23).

Like other small items of jewellery or equipment from leggings or footwear, these two belt-slides from Kaupang should be regarded as casual losses. They can be attributed to men from the Frankish realm who were present in the town in the 9th century. As the wearers of very simple spur-sets they are unlikely to have belonged to the noble class. They were, however, mounted warriors and thus of no small account. We cannot exclude the possibility that this sort of simple equestrian gear was produced in Kaupang itself.

Cross brooch

C52519/14951 (Fig. 4.8.1) Bronze, cast with openwork and a conical central boss. Severely damaged (and maybe burnt?) on the four arms. On the underside, the pin mechanism consisting of an anchor and catch cast in one with a highly oxidized, thick iron pin still in place. Expanding arms, 31 x 33 mm; max. thickness 11 mm; height of brooch body including boss 6 mm; weight 7.4 g.

This brooch has the form of an equal-armed cross with curved expanding arms. The severely abraded terminals of the arms cannot be conclusively reconstructed; they were very probably trefoil-shaped, like those from Ris Fattiggård in North Jutland (Ramskou 1950:153, fig. 16), rather than swallow-tailed. Around the central boss, four round holes are (?)cast in; on each of the complete arms there had originally been four dot-in-circle punchmarks.

This brooch belongs to the highly diverse group of some eighty Carolingian-period cross brooches. A very good parallel is that from cremation grave 76 at Ris Fattiggård, Hjørring amt, Denmark (Ramskou 1950:153, fig. 16; Fig. 4.8.2), which in size, material, type and both the openwork and the punched ornamentation, even to the iron pin on the rear, agrees over and again with the specimen from Kaupang.[1] The only exception is that the spaces between the arms of the cross on the Kaupang brooch are peltate while those on the brooch from Ris Fattiggård are convex and rounded. This "Kaupang-Ris Fattiggård Type" can be classified as a subtype of the "cross brooches with anchor-shaped arms" (*crux ansata*), the arms of which, however, are not formed as trefoils. These simple bronze castings of the early 9th century also show a raised centre, but also usually four additional diagonal arms (Fig. 4.8.3; Wamers 1994a:134–41). A number of them carry small cabochon glass inlays, which are imitated by the dots-in-circles. They are copies of precious prototypes or altar crosses inlaid with gems (*cruces gemmatae*), something like the Ardenne cross of the first half of the 9th century in the Germanisches Nationalmuseum, Nuremburg (Jülich 1999). The cross brooches with ansate arms are hitherto known from Westphalia across the Main-Mosel area as far as Munich (Endres and Riedel 2003), with one Insular variant from York (Gerchow 2005:fig. 2a).

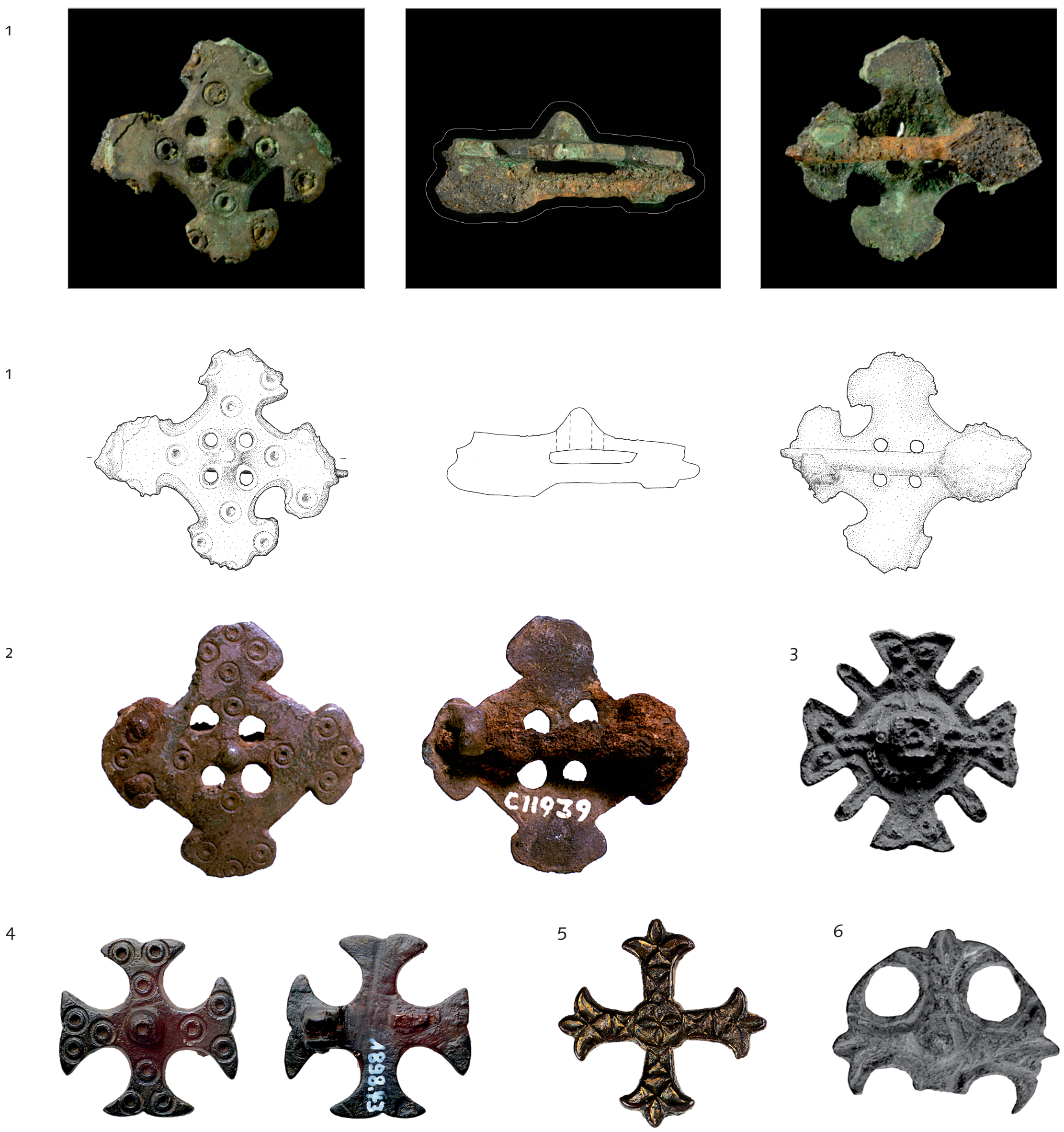
Another close parallel to the cross brooch from Kaupang is an example which was found in 1898 near the Porta Nigra in Trier (Fig. 4.8.4; Böhner 1958:163, pl. 18.9). At about 25 mm long this is somewhat smaller, however, and it has ansate rather than trefoil arms; however it does have the central boss and the dots-in-circles. The brooch from Armentières (Aisne) with curved arms and naps (Naissance 1991:360.13 with fig.) ought to be a late Merovingian brooch-type.

In respect of the form of the arms, the brooches from Kaupang and Ris Fattiggård are most similar to the cross brooch from "Kruft bei Andernacht", Nordrhein-Westfalen (Fig. 4.8.5; Rheinisches Landesmuseum Bonn, Acc. No. 2624),[2] and the disc brooch with cruciform openwork from Domburg (Fig. 4.8.6; Capelle 1976:no. 92). A garnet-ornamented gold brooch in Bonn Minster (*Steinplattengrab* [flagstone cist] 29: Lehner and Bader 1932:171–2, pl. 35.6) may also be cited. Shooting out in the centre between the lunate bows are pointed oval or rounded leaves or shoots, on account of which these pieces were classified as a sub-type of the "cross brooches of floral type" in my study of cross brooches of 1994 (Wamers 1994a:141–2), although in terms of style they are extremely varied. The Early-medieval concept of the cross as the tree of life (*arbor vitae*) lies behind the floral elements. In the Kaupang/Ris Fattiggård type of cross brooch, then, both concepts of the cross, as *crux gemmata* and *arbor vitae*, are

Figure 4.8 *1. Carolingian cross brooch from Kaupang (C52519/14951). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh. Comparanda: 2. Ris Fattiggård, grave 76; 3. Mainz; 4. Trier; 5. Kruft; 6. Domburg 92. (Scale 1:1).*

1 Size: 35 mm x 35. My thanks to Anne Pedersen, Copenhagen, for drawing my attention to this brooch.

2 Ament 1976:67 and 203, pl. 80.1; in Dinklage 1941:245, pl. 3.1, it was erroneously given as from "Elsdorf, Kreis Bergheim". Length of brooch, 28.6 mm. According to information kindly supplied by Dr Jochen Giesler, Rheinisches Landesmuseum Bonn, in the Accession List under the heading "Excavations of Spring 1882 at Kruft bei Andernach", finds primarily of the 7th century, but with a few very late brooches, have been catalogued together, amongst which no discrete grave assemblages can be identified. The find-place "Kruft" should, however, be identified.



integrated. In its mode of manufacture and style, it is to be compared first of all with the brooch from Trier.

Some 6–8 further cross brooches of this type are now known from Jutland, in particular from Ribe and its hinterland (pers. comm., Claus Feveile; see also Feveile, forthcoming in *KUML* 2011). This appears, then, to be a type of brooch that is found above all in Denmark but which derives typologically from the Carolingian-Continental range of brooches. The find-spots in the West of Jutland, from Ribe to Ris Fattiggård and on to Kaupang, suggest that trading routes to the Continent were the key intermediary link.

Up until now, the context of the cross brooch from Münster, which is from the footpath level beneath the earth and timber rampart of Mimigernaford (Münster), has been taken as key evidence for the dating of the brooches with ansate arms. This defensive work, hitherto dated "c. AD 800" (Winkelmann 1964:43, fig. 13; cf. Wamers 1994a:136), will now be placed some 100 years later (Kroker 2005:232–3), principally on the evidence of the pottery assemblage. All the same, the small cabochon glass inlays on some of these brooches (as also, for instance, on some Tassilo Chalice-style objects), and their form reminiscent of chip-carving, point to the decades around the year 800 (Wamers 1994a:136; B. Thier in Isenberg and Rommé 2005:205). Any more precise dating for the type-group Kaupang-Ris Fattiggård than to the first half of the 9th century is scarcely possible. The chip-carved decoration of the Kruft brooch also points to the decades around 800, while the specimen from Domburg would simply be assigned to the "9th century". Amongst the finds associated with the gold brooch from the subsequently robbed Steinplattengrab 29 in Bonn Minster there are also Roman (an Aucissa brooch, sigillata etc.) and Migration-period finds (a rock-crystal buckle); however the gold brooch lay – and remained undetected – together with Late Merovingian- or Early Carolingian-period gold *Schleifenohrringe* [slip-knot ear rings] and a finger ring on the base of the coffin and probably formed the original burial deposit of the late 7th or early 8th century. The brooch from Kaupang should be dated to the first half of the 9th century.

As of yet, there is no known evidence from the Continent in the form either of burial contexts or of pictorial representations that cross brooches were worn by men. Besides the specimen from Ris Fattiggård, there are six further Continental cross brooches known from Scandinavia, all of which represent different types (Wamers 2004:57, Liste 3). The cross brooch from Ris Fattiggård grave 76 is from a cremation burial beneath a barrow where it was associated with three beads, two of which are millefiori beads (Ramskou 1950:153–4), indicating a woman's grave. The cross brooch from Hauge in Møre og Romsdal is from a woman's grave of the second half of the 9th century (Wamers 1994a:136 n.446), while that from Kroken, Aust-Agder, which because of its secondary perforation for decorative chains must have been worn by a Scandinavian woman as a third brooch, was found together with further pieces of female jewellery (beads, and a looped dirham t.p.q. 778/9) and a Trewhiddle-style strap-end in a hoard of the second half of the 9th century (Wamers 1985:75 and 102, cat. no. 112, pl. 38.5). Since Christian allegiance, in 9th-century Scandinavia, is in evidence with women earlier than with men (Gräslund 2001:65–71; Wamers 2004:51), it is also reasonable to postulate in the case of the cross brooch from Kaupang that it may have been worn by a woman: just as likely worn by a woman from the Continent as one from Scandinavia.

Carolingian copper-alloy brooches practically always have, as far we know, pins made of iron wire. Whether the heavy iron pin on this brooch is original or from some secondary refurbishment, we cannot tell; in any case the pin shows that the brooch was indeed worn as a brooch in Kaupang. It was probably a casual loss. It is not possible to determine for certain whether or not the woman who wore it was from the Continent or was local. This is also the case with the brooch of the same type found in cremation grave 76 in the Scandinavian cemetery of Ris Fattiggård, on the northernmost point of Jutland, along with imported millefiori beads, since cremation was also practised in Frisia in the 8th and early 9th century, often with a barrow raised over the burial too (Schmid et al. 1998:60). All the same, the brooches from Kaupang and Jutland reveal a common cultural milieu stretching from Jutland to Vestfold in the 9th century, in a context of trade and personal mobility which supported intense Continental influence that extended to matters of religion (Wamers 2004). The brooches from Jutland and Kaupang may constitute evidence of direct trade/contact with Frisia and the Frankish realm — possibly even the presence of Franks or Frisians in person. At the very least, Frankish/Frisian trade was the precondition for the introduction of these brooches; however they were not themselves the objects of trade. From long experience with simple dress accessories of the Early Middle Ages, the present author considers it relatively unlikely that brooches which in the 8th and 9th centuries were still ethnic and cultural markers as well as, above all, social markers, served also as genuine commodities which could successfully be traded for profit in alien cultural contexts.[3]

Fragment of an equal-armed brooch

C52519/15960 (Fig. 4.9.1) The arm shown is bent longitudinally. Broken off at the bow; barely 50% of the brooch remaining. On the underside a short section of the cast-in-one pin-fitting remains where – since it is not centrally placed – it must have been the pin-catch; the folding of the projection for the catch has not been undertaken. There is no visible perforation to anchor a pin.

The cast decoration in the manner of chip-carving forms a pattern of round-moulded pairs of leaves, but this has not been worked further (engraved or chased), matching the situation on the underside. This is probably an unfinished, failed, casting. Surviving length 16 mm; original length c. 40 mm; max. width 8 mm; thickness (excl. pin-catch) 2 mm; weight 1.8 g.

This brooch belongs to a large group of equal-armed brooches with plant decoration, often simpli-

3 Just as other Continental artefact-forms, the Carolingian and Ottonian cross brooches and cross pendants provided a stimulus and a model for new Scandinavian forms of jewellery (cf. Vierck 1984:fig. 175-D). It should be open for investigation to ascertain whether the production of rhomboidal Borre-style brooches of the Hedeby Type (Capelle 1968:47, pl.9.1–2, and mould, pl. 10.2) was inspired by Carolingian cross brooches (Kaupang/Ris Fattiggård Type or the "Cross brooch with trefoil points" Type: Wamers 1994a:139, fig. 81.A42, Distribution Abb. 83), by Ottonian square brooches (like the Karlburg Type: Wamers 1984:129–32 and fig. 79), or rather by cruciform strap-dividers within horse-harness (Skibsted Klæssøe 1999:97, and figs. 6a–d).

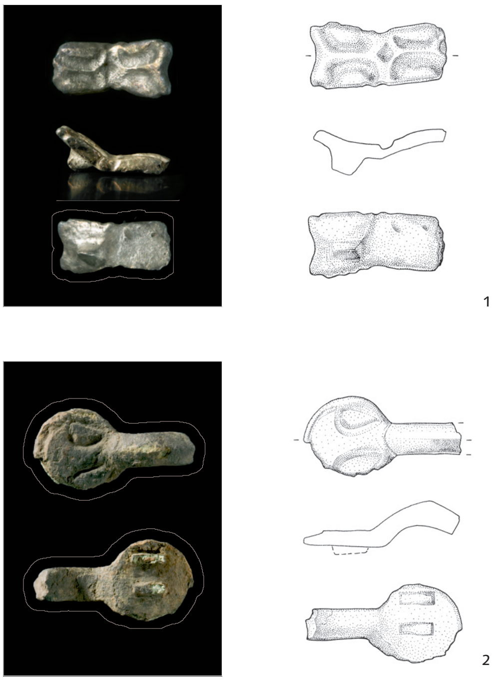


Figure 4.9 *Two Carolingian equal-armed brooches from Kaupang (***1.** *C52519/15960;* **2.** *C52519/14481). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

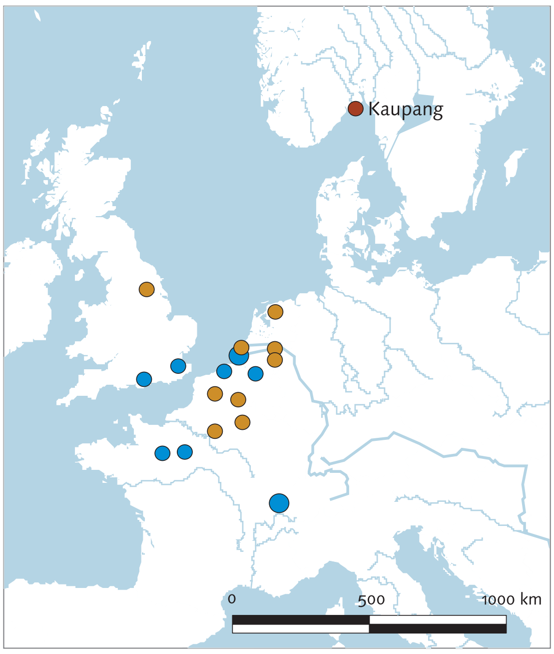
Figure 4.10 *Distribution of three types of equal-armed brooches in Western Europe. Blue: Type Thörle II A 1c; orange: Type Thörle-"Pommerœul"; red: Kaupang. Map, Elise Naumann.*

fied to purely geometric forms. A sub-group is formed of brooches with a flat, broad body and "spooned" leaf-decoration; these date from the end of the 8th century into the mid-9th (more or less Thörle's group "Pommerœul"). The late dating of this sub-group through the specimen from York, which, according to R. Hall, derives from a layer of the 10th century (Hall 1984:102–3; Thörle 2001:193) is not very likely. From Domburg there are several close parallels (Capelle 1976:nos. 26–8), on the strength of which this sub-group has also been christened the "Domburg" Type (Wamers 1994b: 588–9, fig. 176.9; Thörle 2001:185–188, pls. 54–6: "Typ Domburg und Varianten"). While the majority of equal-armed brooches are in copper alloy, several of the Domburg examples are cast in silver. They are c. 26–50 mm in length, but most are under 40 mm. Their distribution runs from Frisia across the Netherlands and Belguim to north-eastern France (east of the Seine); of significance is a large copper-alloy mould from York (Thörle 2001:map 31; Fig. 4.10, orange symbol). This should also be the area of origin of the broch from Kaupang. If it really is an example of a semi-manufactured piece so that the brooch would in fact have been cast in Kaupang, it would mean that people from that region, probably from Domburg itself, were making brooches of their own traditional style in Kaupang and thus most likely for northern Frankish or Frisian residents of the town. This would render it less likely that semi-manufactured brooches were deliberately brought from the central Frankish region or from Frisia to a far-distant trading site.

Fragment of an equal-armed brooch

C52519/14481 (Fig. 4.9.2) Broken at the bow, but over 50% remaining. Cast copper alloy; substantial bow with a cross-section in the shape of a pointed dome. The surviving round end-plate has carved decoration – probably cast in and re-cut – in the form of two drops in the form of semicircles. This pattern is probably a degenerate cross-disc motif. The cast-in-one pin-anchor is now extensively corroded. Max. length 21 mm; original length c. 40–45 mm; max. width 11 mm; weight 1.4 g.

This brooch is best assigned to Thörle's Group II A 1c. Ornamentally, the closest parallels are from Bray Dunes, Dép. Nord, Belgium (Thörle 2001:pl. 13.5–16; Bray Dunes: Thörle 2001:pl. 13.12), while



brooches from Domburg are also similar (Capelle 1976:nos. 51, 53 and 55). The distribution of Thörle's Group II A 1c runs from Domburg, across Belgium to north-western France (the Seine basin and Le Mans area); scattered finds extend to the south-east of England (Thörle 2001:map 8; Fig. 4.10, blue symbols). This distribution is also fully congruent with that of the other equal-armed brooch from Kaupang, and – on present evidence – completely excludes the Middle Rhine area.

Thörle (2001:92, tab. 7) offers no secure dating for the brooches of Group II A 1c; in the case of the pair of brooches from Doubs grave 142 he seeks to mount an argument on the basis of the associated chain of S-shaped links for the younger or late Merovingian Period (= Ament JM II/III), which would approximate to the period 630–720 (Thörle 2001:88, pl. 13.14–15). However, the brooches of the more particular Kaupang/Bray Dunes/Dorestad Type, with their drop-shaped chip-carving, correspond in ornamental terms first and foremost with cross and cross-disc patterns of the second half of the 8th and 9th centuries that are common on equal-armed brooches from Domburg graves 51, 53 and 55 (Capelle 1976) and on Carolingian disc brooches.

After the Merovingian Period, equal-armed bow brooches were almost exclusively worn by women, in most cases just as singletons to fasten a mantel or shawl. The relatively common brooch-pairs of the Merovingian Period (sometimes, indeed, in combination with other brooch-types, or in sets of three or more brooches) are only rarely attested in the core of the Carolingian realm. Examples include the pair of splendid silver brooches from the hoards of the second half of the 9th century of Camon and Muizen, which testify to a continuation of the mode of wearing equal-armed bow brooches in pairs, at least in socially elevated circles (Périn and Feffer 1985:421 with fig.).

Both of the equal-armed brooches from Kaupang were presumably worn by women from the North Sea coastal region or from northern France in the first half of the 9th century. It is striking that both were broken off at the bow even though these were solid, fully cast pieces. Continental equal-armed brooches are only exceptionally combined with Scandinavian oval (tortoise) brooches in the North: one example is in grave 81 at Nebel on the North Frisian island of Amrum (La Baume 1952–1953:33–5).

Double-ended dress-hook (Agrafe à double crochet)

C52519/28305 (Fig. 4.1.1) Cast copper alloy; slightly damaged. Bow-shaped double hook with a narrow, rectangular body in the centre of which a hole has been drilled. The slightly thicker head is also decorated with eight slightly diagonal moulded ribs; on

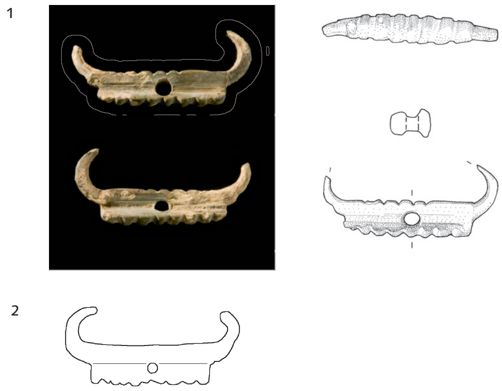


Figure 4.11 *1. Double-ended dress-hook (Agrafe à double crochet) from Kaupang (C52519/28305). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh. Comparandum: 2. Troyes.*

the underside of this there are five further, lower ribs: three small ones in the centre and one larger one at either side. The side fields are slightly moulded and have longitudinal scratches, probably the result of wear. Length 23 mm; max. width 4 mm; max. thickness 5 mm; diameter of perforation 2 mm; weight 1.1 g.

Agrafes à double crochet were a common form of dress-fastener for Gallo-Roman women of the Frankish realm in the Merovingian and Carolingian Periods (Fouet 1963; Hübener 1971). The hooks provided both the simplest and the cheapest form of dress-fastening. It is common for one hook to have been broken off or, as on the Kaupang example, bent: evidence of substantial day-to-day use.

Since the survey by Hübener (1971) a full and practical examination of these double-ended dress-hooks has been wanted; more than anything else, we need a systematic typology and chronological study. There are predecessors already in the Late Antique Period, and most of these are found in Merovingian-period graves: Roes pointed out finds from Carolingian-Ottonian burials and from find-spots in the Netherlands; a few examples are apparently datable to the High Middle Ages (Roes 1954). The centres of gravity in the distribution map – which is not, however, chronologically differentiated – lie in Burgundy (including western Switzerland) and in the Paris basin from the Île de France to Champagne. Finds in Aquitaine and the area of the Rhine mouth are fewer (Hübener 1971:fig. 5). There are close parallels to the Kaupang type from Ther by Beauvais (Oise), Troyes, Champagne (Fig. 4.11.2), and from

4 Pers. comm. Lucas Clemens, Trier.

Figure 4.12 *1. Carolingian mount-fragment from Huseby (C52518/1). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Comparanda: 2. Thurible from Stara Vrlika, not to scale; 3. plaquette from Bojná (diam. c 10 mm).*

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Lac de Paladru (Isère), Burgundy, where they belong to Carolingian and Ottonian contexts (Paris 1999: 183–201, fig. 30.13; [without author] 1987:73, fig. 68; Colardelle and Verdel 1993:338–9, fig. 253:32).[4] A very close parallel, also fluted like that from Ther, is from the cemetery of Mondeville, south-west of Caen, and is dated to the late Merovingian Period (Périn and Feffer 1985:358–61, fig. 142.9). No closer dating for the dress-hook from Kaupang than to the period AD 750–900 seems possible as of yet.

Similar to the equal-armed brooches, these hooks were worn in pairs. The overwhelming majority are perforated as the piece from Kaupang is, so that they could be linked with chains (about 40 cm long).

Apart from the area of the Rhine mouth, for instance Dorestad, Domburg, Schouwen and Leiden (Roes 1965:16, fig. 6 and pl. III.16; Capelle 1976:nos. 434–5, 1978:nos. 83–7; Braat 1964:figs. 6.2–3), the dress-hooks are found only in the Romance-speaking area of France. In the Netherlands they probably reflect the presence of traders from western Francia, along with their womenfolk. This should also be the case with the dress-hook from the trading site of Kaupang; the importation of such a specific dress-accessory as an item of trade can be ruled out.

4.1.2 A find from Huseby 2000–2001

Mount-fragment

C52518/1 (Fig. 4.12.1) Long and thin, broken off at both ends and along both sides. Gilt copper alloy; fragmentary. The decorated part consists of a thin, flat, basal sheet on to which a piece of repoussé foil pressed crossways in a box pattern with slightly sloping sides has been fixed (soldered?). The box-shaped upper side has, in relief, a row of beading between two emphatic, moulded ridges. The background is textured to form a contrast with the smooth "beads". The side faces of the basal sheet have been decorated with opposed punched triangles (the "dog-tooth pattern") of which one is deeply "dotted"/hatched, the other stands out as blank, each with a central groove. The hatched triangles, however, have not been produced with the same patterned triangular stamp, but rather have been individually formed by chasing. Max. length 55 mm; max. width 8 mm; max. thickness 2 mm; weight 2.1 g.

There are no known close parallels for this object. Both stylistically and functionally it is difficult to classify. While Scandinavian art offers no stylistic parallels at all, there are some correspondences in Insular, and particularly in Continental, finds.

Opposed hatched triangles are sometimes found in Insular metalwork, for instance on the buckles from Nordrum and Østensbu, and from Menzlin (Wamers 1985:pls. 28.2–3 and 29.3). As background texture too, they are found on probably Northumbrian products such as the mounts from Rise and Vatne, or the sheet-metal mounts of the situlae for holy water from Birka, Hopperstad or Torshov (Wamers 1985:pl. 6.1; Bakka 1963:24–33, figs. 23–8). There are also highly moulded ridges between fields on products of Irish metalwork, both ecclesiastical and secular in character (e.g. Wamers 1985:pls. 3.3, 16.5–6, 19.1, 20–22.1 and 24–6).

Rows of beads between ridges are common on Carolingian metalwork of the first half of the 9th century, firstly in the filigree style (cf. particularly the spurs with fittings from the Bohemian princely grave of Kolín: Lutovský 1994:figs. 4 and 5.1–6; Fig. 4.6.3), but also in heavy, castings (H. Vierck in Vierck and Capelle 1975:130; Wamers 1994a:148–9, cf. also fig. 86, 1994c:14–17). Strips with opposed triangles picked out with contrastive incised decoration or alternately hatched and blank are relatively familiar, too, in the milieu of the Tassilo Chalice Style: sometimes at the terminals of strap-ends where they are combined with beaded rows by round beaded rivets. Examples of this would be, for instance, the strap-ends from Dorestad, Enger, Medvedička, Gornji Vrbljani and Rossum (Haseloff 1951:fig. 31 and 25; Vinski 1977–1978:pls. I–II and XVI–XVII; Ypey 1962–3). Such a combination is also found on the small censer from the well of Cetina in Dalmatia, where rows of triangles are found in combination with beaded wires on the three-armed chain-divider and on the foot (Fig. 4.2; Wamers 2005a:cat. no. 29). Particular good parallels are offered by the six pressed decorative gold-foil mounts from a liturgical object (a reliquary, portable altar, or something of the sort) that have recently been found on the "Burgwall" of Bojná I-Valy near Nitra in Slovakia (Pieta, Ruttkay and Ruttkay 2006:21–69, figs. 11–20 and pls. 22–42). Three of the four round foils, and both cruciform pieces, which all bear figural decoration, are surrounded by ring-shaped frames with opposed punched triangles that are alternately smooth and filled with dots (e.g. Fig. 4.12.3). This dotting corresponds to the hatching of the triangles on the Huseby mount, where in both cases the filled triangles radiate out from the inside towards the edge. The rings of triangles on the round foils are framed by substantial rows of beading on both their inner and the outer sides, just like the lines of triangles on the foot and suspension handle of the thurible from Stara Vrlika (Fig. 4.12.2), which has a further counterpart in the central burled row on the Huseby fragment. Doubled rows of burls like this used as frames are also found on the cruciform foils from Bojná.

In their pictorial field, the Bojná foils are decorated with winged Christian figures (angels and seraphim) and (cross-)nimbed saints, with some Latin inscriptions. The publisher of the find has identified the decorative foils, in a primary stylistic attribution, as Western, and has dated them according to the functioning phase of the "Burgwall" to the late 8th or first half of the 9th century. This is convincing, above all with regard to the features noted above relating to the artistic repertoire of the Tassilo Chalice Style. They can in all probability be identified as East Frankish work. Thus, for the Huseby fragment too, a dating to the late 8th or first half of the 9th century can be proposed; certainly no later than 900.

No firm conclusion can be drawn concerning the function of the object. No form of attachment can be observed on this nearly 5-cm long piece. The decorative band only 8 mm wide could have been added to either an ecclesiastical or a secular object, for instance on the ridge of a reliquary like that from Ås (Wamers 1985:pl. 9.1), as a fitting on the edge of a small box, or to separate two panels.

4.2 Insular metalwork

4.2.1 The finds from Kaupang 1998–2002

Mount-fragment

C52516/5785 (Fig. 4.13.1) Small fragment of a thin strip of sheet copper-alloy, curving lightly. Incised on the convex "outer" face. Broken off or cut on at least three, perhaps on all sides. A narrow strip of foil has been separated off along the lines of incision and bent slightly away. To the lower end, and probably towards the upper left edge too, there remains a rivet-hole from the initial fixing. A few, very small traces of rust on the rear should represent contact oxidization, while the further small holes at the lower end should be the result of later damage. The incised decoration consists of angular interlace in the form of a lattice, with pointed oval loops in the wedges between the rhombuses. The background is diagonally hatched. Max. length (= height) 38 mm; max. width 11 mm; max. thickness 1 mm; weight 0.4 g.

The decoration matches almost perfectly that of the central strip on the bucket from the female grave 40 at Skei, Steinkjer, Nord-Trøndelag (Fig. 4.13.2; Graham-Campbell 2001:fig. 3.3; Stenvik 2001:28–31, fig. 19), except for the band that runs along the middle, which is absent. The grave at Skei also contained

Figure 4.13 *1. Insular mount-fragment from Kaupang (C52516/5785). Photo, Eirik Irgens Johnsen, KHM. Comparandum: 2. Skei. (Scale 1a, 2:1; 1b, 1:1; 2, 2:3.)*

further Insular artefacts in the form of a reliquary- or harness-mount reworked into a brooch, a ladle, and a triangular hanging-bowl. The size of the Kaupang fragment (height, 38 mm) also corresponds closely enough with the estimated 40 mm of the central strip of the Skei bucket. While the bucket itself can be dated to the 8th century (Graham-Campbell 2001:30–1), the burial was not made until the early 9th.[5] Thus the Kaupang fragment belongs to the small group of complete (Skei, Hopperstad, Birka) and fragmentary (Torshov) Hiberno-Northumbrian situlae (buckets) for holy water found in Scandinavia.

Whether this had come to Kaupang as an ancient fragment of a once splendid souvenir from the West, we cannot now tell.

Mount-fragment

C52517/959 (Fig. 4.14) Gilt copper alloy, possible enamel inlay. Severely corroded. An oblong, box-shaped mount with slightly slanting sides and weakly S-shaped in profile. The – maybe – undamaged end has a rounded point. The underside is hollow, and at the rounded, unbroken end there is a cast-in lug in which no perforation can be made out. There is a second, smaller lug at the other, broken end. Both of the now incomplete lugs served originally either as looped lugs for fastening the mount to a leather strap, or as cast-in rivets for fastening the mount to a wooden(?) base. The x-ray photograph clearly reveals two drilled perforations on either side of the fuller lug, which either served as additional fastenings of the mount to its original base or – what is here regarded as more probable – to support a sec-

5 Stenvik's earlier dating of the Berdal-type oval brooches to the second half of the 8th century based upon the stratigraphical evidence from Ribe (Stenvik 2001:32–3) is not followed here. On the dating of the Gripping-beast Style and the stratigraphy of Ribe, cf. Wamers 1999:198–200; see also the revised stratigraphy and dating: Feveile and Jensen 2000.

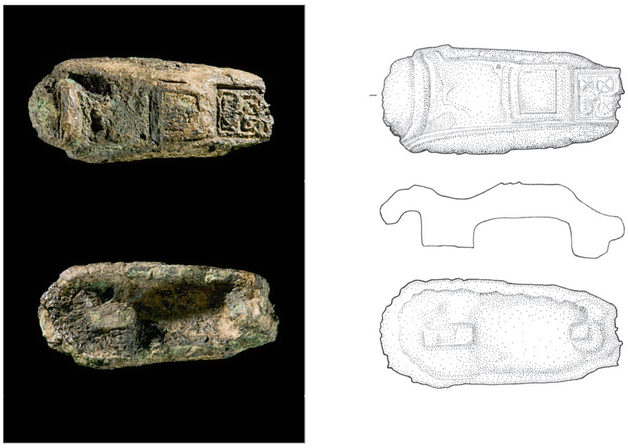

Figure 4.14 *Insular mount-fragment from Kaupang (C52517/959). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

ondary pin-holder. It is precisely here that there are traces of rust on the underside, probably the remains of an iron pin attached secondarily to the object.

The upper face has three quadratic fields, one with chip-carved interlace decoration, one a cell for an enamel or amber(?) inlay, and a diagonally sloping field with no recognizable decoration. On one of the sides further interlace can be made out, as one could also postulate for the other side. Max. length 32 mm; max. width 13 mm; thickness 9 mm; weight 10.3 g.

The original function of this object can only be guessed at now. Insular strap-mounts from horse-harness, bridles or the like are usually plane rather than hollow on the underside. C52517/959 may have been part of the suspension fittings of a reliquary, or have served as a side- or ridge-mount for a shrine, as reliquary mounts are often bossed or pyramidal in shape (Wamers 1985:pls. 6–16; M. Blindheim 1984). That this was originally a brooch (equal-armed?) is less probable because of its unusual and asymmetrical form.

The recognizable remains of decoration (one-stranded chip-carved interlace with "Brezel"-motifs, and a square setting with a ridged edge to hold the inlay) locate the fragment in the "Insular" context: i.e. that of Hiberno-Scottish/Northumbrian metalwork of the second half of the 8th and the 9th century.

This mount was probably re-worked into a woman's brooch in Scandinavia, as was the fate of so much Insular metalwork. The fragment must then be treated as a piece of Scandinavian jewellery, and would thus, if it represents a casual loss, be evidence for the presence of a Scandinavian woman at the site. As a fragment it could, however, have been part of the scrap-metal stock of a jeweller in Kaupang.

Fragment of an annular brooch (pseudo-penannular)

C5251/2642 (Fig. 4.15) Cast copper alloy and tinned(?). The underside is slightly convex, the upper side plane. Traces of oxidization of the copper at one end, where a secondarily added copper-alloy rivet is evident, possibly evidence of the re-working of the brooch. The broken edges seem to have been struck off. The marks of cutting on the underside do not form any recognizable deliberate pattern and are presumably wear-marks. The relief decoration (cast and sharpened manually?) on the upper side consists of an angular plait inside a double border line. Max. length 17 mm; max. width 12 mm; thickness 3 mm (max. 5 mm); weight 37.16 g. Width of ring 12 mm; original outer diameter of the hoop c. 90 mm.

This is undoubtedly a fragment of an Insular (pen)annular brooch, in size of the order of the known specimens from Snåsa, Bergøy, Eidsfjord, Perthshire, Kilmainham and others (Wamers 1985:pls. 33.1, 34.2–3; Youngs 1989:cat. nos. 72 and 74). From the material and the careless execution of the decoration, this brooch is one of the simple examples imitating the valuable gilt silver de luxe brooches such as those from Dunbeath, Hunterston, Bettystown, Westness, "Londesborough", County Caven, Kilmainham and Armagh (Youngs 1989:figs. on pp. 74–6). It is not possible to date the fragment more precisely than to the 8th or 9th century, or to provenance it more closely than to Ireland, Scotland or Northumbria.

To date, half-a-dozen fragments of Insular penannular brooches are known from Norway that had been functionally adapted by adding a pin-catch to the brooch. While the Insular brooch-pins (as well as the ringed pins) were predominantly worn by men as a cloak fastener in Scandinavia, the fully preserved (pen)annular brooches and the re-worked fragments are from women's graves (Wamers 1985:36–7). The fragment from Kaupang – possibly

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originally as a larger piece – will therefore also have been worn by a Scandinavian woman.

Figure 4.15 *Insular fragment of an annular brooch (pseudo-penannular) from Kaupang (C52517/2642). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM.*

Figure 4.16 ***1.** Insular mount-fragment from Kaupang (C52519/19592). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Comparandum: **2.** Penannular brooch from Dooey in Co. Donegal, Ireland.*

Figure 4.17 *Insular mount-fragment from Kaupang (C52519/24653). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM.*

Mount-fragment

C52519/19592 (Fig. 4.16.1) Three fragments and one splinter of an oblong mount. Cast copper alloy with microscopic traces of gilding. On the underside of the largest piece is what is left of a rivet or a loop with pieces of copper alloy left in place: probably the remains of a secondarily added pin-catch. Broken off at one end, where a circular field is marked out. The cast decoration of the chip-carving style consists – insofar as it survives – of curved, round and half-moon-shaped fields drawn by compass, and a protruding tongue at the preserved end. The incomplete circular field is filled with single-stranded interlace in the surviving area around the edge. Max. length 28 mm; max. width 14 mm; thickness 4 mm; weight 3.4 g.

Decorative motifs compass-drawn and swelling in part, composed in geometrical or plant patterns, are typical of a number of pieces of Irish metalwork, principally of the 9th century. On both bridle-mounts and penannular brooches there are also circular and half-moon-shaped fields and cells that were sometimes formed as the settings for inlays, mostly of amber (e.g. Wamers 1985:pls. 7.1, 20–22.1, 27.1 and 33.1 and 33.4). The closest parallels stylistically are found on a number of brooch-pins from the counties of Donegal, Galway and Meath; from Dooey in Co. Donegal there is also a lead model (Fig. 4.16.2; Youngs 1989:193–4, cat. nos. 185–6). The decoration can be considered as a late development and simplified derivative of the scroll-and-trumpet motifs. The pointed double volute at the end of the Kaupang fragment is of vegetable character and comparable to the buckle-mount from Prestegården, Møre og Romsdal (Wamers 1985:pl. 29.1). The single-stranded, loosely wound but narrow interlace pattern is of Insular type, and is found on numerous mounts from both ecclesiastical and secular contexts of the 8th and 9th centuries (e.g. Wamers 1985:pls. 1–7, 9–13, 16–17, 20–2, 24–30 and 33–5).

The fragments from Kaupang are probably also the remains of the plate of a belt buckle such as that from Prestegården. Since they were apparently subsequently re-worked into a brooch, this could originally have been a bridle or some other special mount. Insular belt-buckles were not re-worked in the Scandinavian milieu (including Scotland and Ireland, etc., where there are Insular buckles in Scandinavian graves) but rather used as originally intended (Wamers 1985:40–1, tab. 1).

Mount-fragment

C52519/24653 (Fig. 4.17) Rectangular, damaged on the underside. Cast silver, with major copper florescence. On the underside at the middle of the shorter ends are broken remains of once cast-in rivets or a large hoop. On the face is a symmetrical pattern of one-stranded chip-carved interlace. Max. length 20 mm; max. width 15 mm; thickness 4 mm; weight 2.4 g.

The interlace shows the object to be an item of Insular metalwork of the late 8th or 9th century. The fragmentary prongs on the underside can hardly be the remains of inserted rivets or a stepped loop as they are not placed right on the outer edge. It is most likely that they are what remains of a cast-in loop here; the mount would then correspond with the strap-slides of Carolingian spur-sets (cf. C52517/867 and /900; Figs. 4.7.1–2), from which simplified Viking-period examples must have been derived (Rygh 1895:nos. 584 and 604). No Insular strap-slides have been found as of yet, and silver is an uncommon material for Insular belt-mounts. Could this possibly be a piece of work which was made by an Insular jeweller in Insular style, but in Kaupang, and for a Continental customer? If indeed this was a strap-slide of Continental type, the Carolingian chronology indicates that it can hardly have been made before AD 800.

Figure 4.18 *Insular gold appliqué from Kaupang (C52519/14057). (Scale 2:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 4.19 ***1.** Insular gold mount from Kaupang (C52519/15773). (Scale 2:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh. Comparandum: **2.** County Caven brooch, ring terminals. (Scale 1:1).*

Gold appliqué

C52519/14057 (Fig. 4.18) Gold foil with gold filigree appliqué, slightly moulded in cross-section. Cut at the edges; in some places damaged. The edge bent over downwards and slightly raised. Probably cut out of a larger decorative piece. Part of the filigree appliqué has been lost. The border is formed of single-stranded beaded wire, and the inner knotted-plait pattern of triple-stranded wire formed of two thinner strands as the base and a thicker wire, worn smooth in places, on top. The pattern has been pressed through to the back. This consisted originally of two interlinked D-shapes. Length 12 mm; width 12 mm; thickness of foil 1 mm; weight 0.1 g.

This filigree foil is clearly an inlay for a larger artefact, such as on the terminal lobes and pin-heads of the (pen)annular brooches or liturgical objects (e.g. Youngs 1989:pls. on pp. 75, 77, 80–6 and 160–2). The technique of the single-stranded and triple-stranded beaded wires cannot be restricted to any one specific area of provenance: it occurs not only in Continental and Insular areas but also in parts of Viking-period Scandinavia. In the 8th and 9th centuries, however, gold filigree is very rare on anything other than Irish metalwork in Anglo-Saxon and Scandinavian regions (on Insular filigree, see Whitfield 1987, 1993, 2001; on Viking-period and Continental filigree, see Duczko 1985; Eilbracht 1999). As a motif, open interlace knots formed of two D-shapes find no exact counterparts, meanwhile, in Hiberno-Saxon art; only more complex forms, for example on the penannular brooches from Armagh and Kilmainham (Cone 1977:col. pl. 49 and 42; cf. also Whitfield 1987: pl. I.g and k, 1993:figs. 14.3–4; Youngs 1989:pls. on pp. 81 and 157–8); simpler forms, however, are also found in areas of Frankish influence (e.g. the mount from Krassum, Frisia: Whitfield 1987:pl. I.h).[6] A close parallel in a good state of preservation comes from the Viking-period (early 10th-century) ship grave at Ladby, Fyn, Denmark, albeit of rectangular shape. The provenance of this object has been given as "Scandinavian, Anglo-Irish or Continental" (Sørensen 2001: 101–2, fig. 4.53). The other non-Scandinavian objects in this royal grave include both Continental and Insular items.

It is thus not possible to determine with certainty whether this piece of gold filigree foil came from the Continent or from Ireland. Chronologically, it should belong to the 8th or 9th century. Its fragmentary state allows us to postulate that it was a piece of 'scrap metal' intended for re-use.

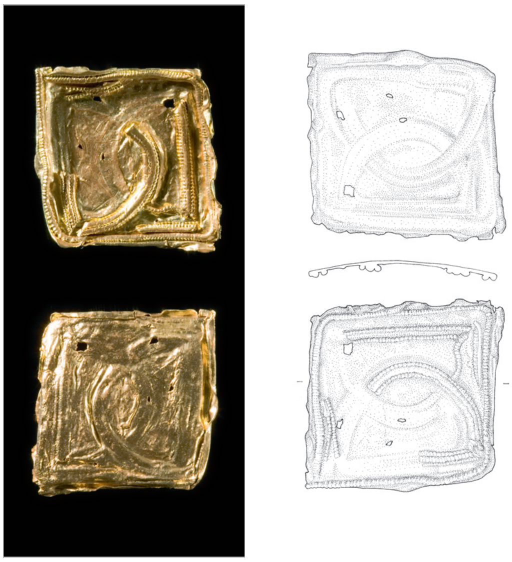
Gold mount

C52519/15773 (Fig. 4.19.1) Small, round gold-foil disc with a raised boss in the centre. The outer rim has been secondarily bent up in places. On the underside a patch on the border in the shape of a crescent can be seen. Slightly misshapen.

The filigree and granular decoration on the face is divided up by three concentric filigree wires that are lightly and irregularly beaded. The innermost, however, is more sharply beaded. The two outer filigree rings border a zone of fourteen granular rings, each with a further gold bead in the centre (except for one, from which this bead has been lost). These rings of filigree are made with the same type of wire as in the outermost filigree ring. The raised filigree ring in the centre contains eleven beads of varying size. Diameter 10 mm; height 1 mm; max. thickness of the foil 2 mm; weight 0.7 g.

6 Examples of Carolingian silverwork in filigree and granulation are consistently more massive and substantial, and make use of heavy, lightly flattened central granules – as shown by riding equipment and fittings for weaponry: cf. Wamers 1994c, 14–19, figs. 13 and 15–16; 2005a:fig. on p.172).

7 The gold filigree metalwork of Gotland of the 10th and 11th centuries (Arbman 1937:189–214 and pls. 56–8) comprises no close parallels to the round setting from Kaupang.



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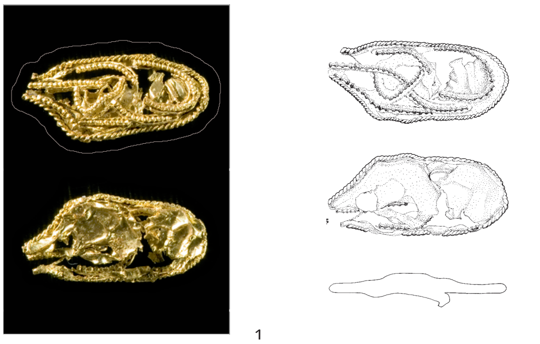
Small plates, both square and round, with gold filigree and granulation were applied to Irish penannular brooches of the late 8th and 9th centuries; for instance on the terminals and pin-head of the brooches from Killamery or "Tipperary", although also on larger examples of the goldsmith's work such as the chalice and paten from Derrynaflan (Youngs 1989: figs. pp. 74–87 and 160–2).[7]

There is a particularly close parallel on the *annular brooch* from County Cavan (Fig. 4.19.2; Youngs 1989:fig. on p. 80; Cone 1977:pl. p. 130–1). The inlays in the terminals are of the same size of 10 mm. There are, however, minor differences: the foils appear to be flat, and there are only ten filigree rings and no middle filigree ring, while the round central field is markedly larger with around three times as many gold beads. Small, round, bramble-patterned decorative fields, either granulated or cast, were a favourite motif of the Irish goldsmith's art of the 9th century that is represented particularly often on the annular and penannular brooches, and which clearly contributed to the development of the "rosette brooches" and probably also of the "thistle brooches" with "brambled bosses" of the late 9th and 10th centuries (Graham-Campbell 1972, 1983). It is conceivable that the gold filigree and granular art of the court workshop of Lothar and Charles the Bald – with its filigree-bordered beads, as represented, for instance, by the sword-belt mount from Hoen or the strap-end of Chateauroux (Wamers 2005a:55, figs. 20 and 80–2, cat. no. 24, fig. on p. 80) – was the source of inspiration of Irish filigree art.

Gold filigree appliqué

C52519/18608 (Fig. 4.20.1) One larger and one tiny, thin gold-foil fragment with applied filigree. The foil has been pressed upwards from the underside. It is approximately U-shaped, with an assymetrically modelled end. The surviving filigree decoration on the face consists of a rim, formed of a single twisted



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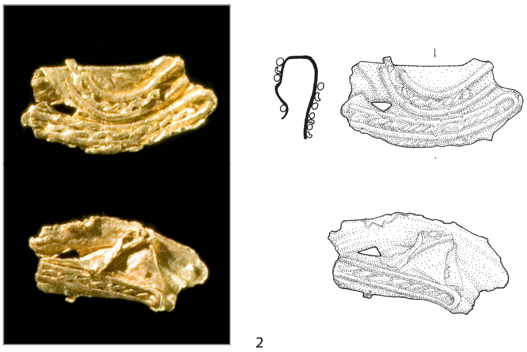

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Figure 4.20 *1. Insular gold filigree appliqué from Kaupang (C52519/18608); 2. Insular fragment of gold with filigree from Kaupang (C52519/16465). (Scale 2:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 4.21 *1. Insular buckle-fragment from Kaupang (C52519/19673). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh. Comparandum: 2. Bishop's Lough.*

gold filigree ribbon, and interlace formed of single-stranded beaded wire sitting in a "tub"-shaped piece of gold foil in such a way as to give the impression of triple-stranded wire. These "tubs" were not soldered separately on to the foil base but rather formed within it itself. The interlace is damaged in several places. Length 12 mm; width 6 mm; thickness 1 mm; weight 0.1 g.

The gold filigree with "beaded wire" and "twisted ribbon" matches Irish/Hiberno-Saxon filigree of the 7th to 9th centuries (Whitfield 1993, 2001). The backing of the filigree wires with a raised back-plate is matched on a fragment from Lagore (Whitfield 2001:143–4, fig. 13.3). The Anglo-Saxon variants are, however, stiffer and stronger in execution (cf. Whitfield 2001:figs. 13.5 and 7–8). The interlace too, insofar as we can reconstruct it, with its open and far from strongly symmetrical curvature, agrees with the products of the Irish art milieu, as are clearly represented by the "filigree panel from a crannog in Ireland" (Alnwick Castle Museum no. 530; Whitfield 2001:fig. 13.9), and on the Tara and Hunterston brooches (Whitfield 1993), and also by cast metalwork (cf. the models for C52519/19592; Fig. 4.16.1).

The present fragment is probably an appliqué for a piece of silverwork such as a penannular brooch of the Tara, Hunterston, Westness or Kilmainham type (Youngs 1989:figs. pp. 74–5, 77–81 and 84–5), or for liturgical objects such as the chalice and paten from Ardagh and Derrynaflan (Youngs 1989:figs. pp. 160–2). At the narrowing end it probably originally framed a round or D-shaped field, probably a setting such as on the handles and prints of the chalice from Ardagh or Derrynaflan, or on the terminal lobes of a penannular brooch (cf. Cone 1977:figs. pp. 112–17; Youngs 1989:figs. pp. 161 upper, 74–5, 78 and 94).

The minute fragments of an originally very precious secular or ecclesiastical piece of metalwork of the 7th(?) to probably the middle of the 9th century came from an Irish-Insular workshop. Whether they came to Kaupang still together with the original, complete and probably silver piece of jewellery or had already been separated for some further use we cannot now determine.

Fragment of gold with filigree

C52519/16465 (Fig. 4.20.2) Crumpled and partially distorted fragment of gold foil with filigree. Composed of two curved lines of filigree lying side-by-side, both formed of triple-stranded beaded wire: one central strand and two finer, lightly beaded strands on either side. Length 6 mm; weight 0.1 g.

Three-wire-bands with a central twisted ribbon are extremely rare in Insular filigree work. Whitfield refers only to the filigree panel from Lagore crannog, Co. Meath, and the brooch-pin from Westness, Rousay, Orkney (2001:145–6; Westness brooch: Youngs 1989:fig. on p. 78.9). While the Lagore panel is to be dated to the 7th century, the pin-brooch is of the 8th century. This variety of filigree with a twisted ribbon, which was probably influenced by Frankish filigree art, appears to be an early phenom-

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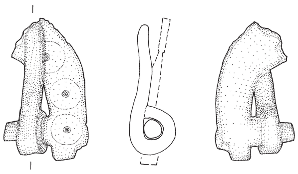

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enon. The Kaupang fragment thus probably derives from some piece of Irish-Hiberno-Saxon metalwork of the 7th or 8th century that cannot now be more precisely identified.

Buckle-fragment

C52519/19673 (Fig. 4.21.1) Fragment, cast copper-alloy. Less than half of the loop survives. The tongue, looped around the remains of the bar, is over-sized, and different in alloy. It may not be the original tongue. Its point has also been broken off. The loop is flat, with a projecting lug at the rear edge, and widening towards the centre, although nothing more can be known about its form there. It is thicker towards where the tongue-bar joins. Large bulls-eye motifs have been stamped on the upper surface. A narrow, conically tapering pin of broad and flat wire. The tongue-bar of rounded drawn wire runs through the loop in the preserved end of the pin, or the loop has been bent firmly around the bar. Differences in coloration suggest that the tongue-bar and loop are of different alloys. Max. length 18 mm; max. width 11 mm; max. thickness 6 mm.

No very close parallel can be cited. One peculiarity is the small rear "sticking-out bits", which are typical of Insular buckles. How the tongue was originally formed, round or oval, we cannot now determine. The bulls-eye punchmarks, however, as simplified skeuomorphs of filigree rings with a central bead, are fairly common in Carolingian metalwork (cf. above, strap-end C52517/844; Fig. 4.5.1), and in both Anglo-Saxon and Anglo-Scandinavian material. Noteworthy are the strap-ends from Carlisle Cathedral (Fig. 4.6.4), probably Carolingian or at least Carolingian-influenced, and from St Patrick's Isle, Peel, Isle of Man, grave IV, 85.60/L (1155), with similarly decorated buckles (Graham-Campbell 2002:91, with further examples), or the buckle from grave 511 at Repton, Derbyshire; the latter, however, with an oval, parallel-sided, narrow tongue and no "sticking-out bits", and a rectangular plate with cut corners (Biddle and Kjølbye-Biddle 2001:figs. 4.14 and 5). That buckle could well derive from some Continental context. However, the Kaupang fragment shows more correspondences with the "Anglo-Scandinavian" (or "Hiberno-Norse") buckles of Type Eigg known from Norse graves in Scotland (Fig. 4.21.2). These have loops which become wider and are pointed, "sticking-out bits" and bull's-eye decoration. Unlike the Kaupang fragment, though, they have curved loops, and a further bar above the tongue-bar, while their bull's-eyes are not large or punched, but small and simply sunken beads (Paterson 2001:figs. 11.1 and pl. 10).

Since the buckle has been provided with a new pin, it had probably remained in use for a long time. From its size, it should have been part of some footwear or spur set, or of a bridle. It could conceivably have been the buckle of a narrow girdle.

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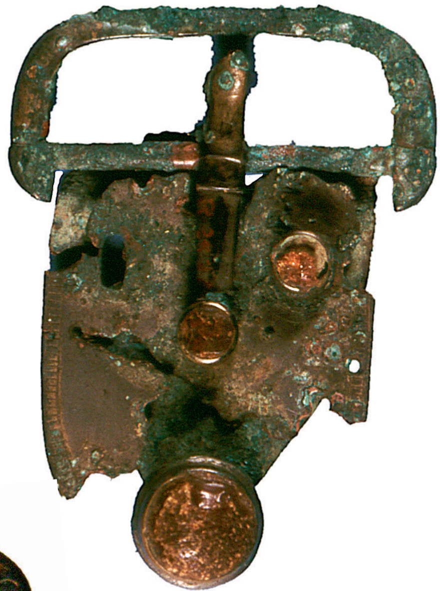

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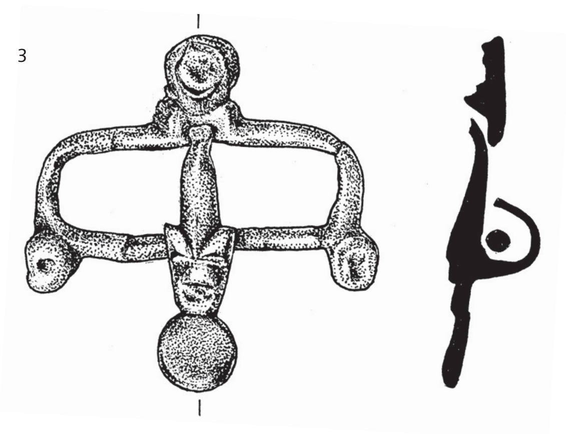

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4.2.2 A find from Huseby 2000–2001

Belt buckle

C52518/48 (Fig. 4.22.1) Cast copper-alloy. D-shaped loop, flat to rounded in cross-section with a round tongue-bar and triangular rear "sticking-out bits". Two round settings at the ends of the tongue-bar with traces of amber within. Max. width 29 mm; max. length 37 mm; max. thickness 5 mm; inner length of tongue-bar 20 mm; weight 5.4 g.

With the projections to the rear and the round, isolated, cast settings for inlays, this buckle belongs to the Insular art and form milieu: most probably that of Ireland. Close parallels are the buckles from Dublin (College Green?: Bøe 1940:43–4 and fig. 25),[8] from the hoard of Shanmullagh, Northern Ireland (Bourke 1993:fig. on p. 25, upper), and from an unknown location in Ireland in the British Museum.[9] All three of these, however, are markedly longer or wider and thus must have been intended for broader belts. The buckle from Dublin has no round settings at the ends of the tongue-bar. The buckles from Dublin and Shanmullagh, on the other hand, have a prominent tongue, the latter with a rounded end (Figs. 4.22.2–4). Such tongues have been found on their own in the man's grave at Nordre Bikjholberget Ka. 279 (Blindheim and Heyerdahl-Larsen 1995:pl. 70e; Stylegar 2007:Catalogue) and grave II/1932 at Birka (Arbman 1940–1943:Text:fig. 458). Also the buckles from the man's grave at Frøyland, Rogaland, Norway (Wamers 1985:pl. 28.4), and from Derry, Co. Down, Ireland (Youngs 1989:cat. no. 203), belong to the corpus of Irish buckles, as probably does the buckle with a slightly trapezoid, plant(?)-decorated loop from Domburg (Capelle 1976:no. 284), and less certainly the fragment from Kaupang just described (Fig. 4.21.1).

In light of the uncertain fine chronology of Insular metalwork, it is difficult to offer a closer dating for any of these parallels than to the late 8th or 9th centuries. As grave goods, the Insular belt buckles are consistently from men's graves (Wamers 1985:41), and it is consequently reasonable to regard the Huseby buckle as a male dress-accessory too. It was made for a belt (from the costume?) a good 20 mm wide.

4.3 General discussion

During the investigations in the settlement area of Kaupang in the period 1998–2003, a total of eleven Continental and ten or eleven Insular metalwork finds were made, including the lead model C52517/635 (Pedersen, in prep.); but excluding the annular brooches (see Graham-Campbell, this vol. Ch. 5:Tabs. 5.1–2). The buckle-fragment C52519/19673 (Fig. 4.21.1) could not securely be attributed to either of those artistic milieux: it is almost certainly not Scandinavian and probably Insular. The proportions of finds from both of these backgrounds is thus even within the area of investigation. From the excavations at Huseby, in addition, the belt buckle (C52518/48; Fig. 4.22.1) can certainly be identified as Irish, while the mount-fragment (C52518/1; Fig. 4.12.1) is very probably Continental (East Frankish).

Figure 4.22 *1. Insular belt buckle form Huseby (C52518/48). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh. Comparanda: 2. Dublin; 3. Shanmullagh; 4. Irland.*

The interpretation of "foreign material" within a generally homogeneous archaeological context of quite different character is recognized as a problem (Werner 1970; Steuer et al. 1999; Wamers 2000). On the one hand, these items can be explained in economic terms as straightforward trade goods in the widest sense of that category, which can be applied to practically all material goods such as raw materials, semi-manufactured and finished products, agricultural produce including animals on the hoof, and even "human cargo" (slaves) – as far as those are archaeologically represented. At the same time, exchange relationships based upon politico-diplomatic and social bases (gift-exchange) can also be considered as the explanations for "foreign material". These would normally be expected to lead to a higher degree of value transferred and a substantial archaeological footprint, since such gifts were, as a rule, prestige goods that were not "consumed" but rather – with an appropriate custom of furnished burial – "conserved" in funerary practice.

Something that has particularly been the subject of long discussion is the classification of dress-jewellery as "foreign material" (systematically by Werner 1961, 1970). In Early Medieval archaeology on the Continent "foreign" dress-accessories, especially when they form part of an alien style of costume inside the grave, are consistently explained in terms of personal movement – in other words through individual (e.g. in marriage) or group migration.[10] Behind this interpretation lies the well-grounded premiss that not only in modern practice but also in pre-modern societies, costumes served to represent ethnic and social identity and difference – along with many other ways of modifying the body such as hair- and beard-styles, painting, tattooing and scarring, the filing of teeth, the perforation and enlargement of segments of skin, and deformation (e.g. of skulls or feet). An especially clear example of this is the Scandinavian women's dress of the Viking Period, which as a rule consisted of a pair of oval brooches combined with a third, not infrequently a fourth, brooch: from central Russia, across Scandinavia (with Gotland being different), to Britain, Ireland, the Northern Isles and Iceland, and northern France (Müller-Wille 1997:fig. 6). It is quite evidence that there was a definite identity for Scandinavian women at least, manifested in the female costume, and that this was maintained even in extreme migration amongst foreign cultural and ethnic contexts (Wamers 1998c:58–9). Only hesitantly were foreign dress-accessories adopted into the traditional set of fittings, and when they were it was only to complete the set as the third or fourth brooch. No complete abandonment of the hereditary Viking-period female costume can be seen, at least in the early phases of contact. The situation is similar with the less distinctive Scandinavian male costume, especially in the case of weaponry and riding gear. Although Carolingian two-edged swords were imported to Scandinavia in great quantity and were copied there, the Carolingian style of wearing a sword was ignored (Wamers 2005a:173). The technique of mounted battle practised in the Carolingian Period, with its typical equipment of spurs, stirrups, bridles and lances, was not accepted into Scandinavia until the 10th century, on the evidence of the equestrian graves (Pedersen 1997:132–3).[11]

These general considerations will form the basis of the following attempt to interpret the Continental and Insular dress-jewellery found at Kaupang.

8 National Museum of Ireland, Dublin, accession no. 2407. Length 57 mm; width (not incl. tongue) 27 mm; inner length of tongue-bar 45 mm. Bøe erroneously attributed this buckle to the Viking-period cemetery at Islandbridge (information kindly supplied by S. Harrison, Dublin). Dimensions of the buckle from Shanmullagh: length 47 mm; width (not incl. tongue) 27 mm; inner length of tongue-bar 35 mm.

9 British Museum NME 1853,11–17,13. Length 55 mm; width 26 mm; inner length of tongue-bar 34 mm. Unpublished. This buckle was purchased from a certain J. Huband Smith in 1853 along with fifteen other objects, all of which were reportedly from Ireland. My warm thanks to Sonja Marzinzik of the British Museum for her kind assistance and the information provided.

10 Cf. the quite varied contributions to the exhibition catalogues *Die Franken* (von Welck et al. 1996) and *Die Alamannen* (Fuchs et al. 1997): Böhme 1996; Bierbrauer 1996; Périn 1996; Wieczorek 1996a and 1996b; R. and U. Koch 1996; Wood 1996; Frank 1997; Schach-Dörges 1997;Koch 1997. See also A. Koch 1998. For a quite different and critical perspective, see Brather 2004a:283–318 and 390–428.

11 Riding gear of the 9th century is found only in the far south of Denmark, in the area under the direct influence of the Carolingian Empire (cf. also Petersen 1951:32–8; Arbman 1940–1943:pls. 33–8). To these are to be added, along with a few items from Hedeby, the equipment from the exceptional boat-chamber grave (Wamers 1994c) and two cremation burials with Carolingian spurs of the first half of the 9th century from the North Frisian island of Föhr (Eisenschmidt 2004:cat. 37 and 41.12, pls. 76.5 and 83.14). The latter are presumably from Frisian graves.

4.3.1 The Continental finds

The Continental-Carolingian fine metalwork consists exclusively of dress-accessories and fittings from weaponry or riding gear. Since no secondary re-working for re-use in a different function could be observed, as is otherwise very commonly the case with Carolingian metalwork in Scandinavia (cf. above, C52517/274 and /1496; Figs. 4.1, 4.8.1), and a few pieces such as the small strap-ends (C52517/844 and C52517/1724; Fig. 4.5.1) and the strap-slides (C52517/867 and /900; Figs. 4.7.1–2) were very probably casual losses, it is likely that these Continental objects were worn at the site and thus constitute evidence for the presence of "foreigners" in Kaupang. This is supported by the double-ended dress-hook (*Agrafe à double crochet*: C52519/28305; Fig. 4.11.1), which – unlike Continental brooches – could not in any circumstance have been accommodated within the Scandinavian female costume and thus cannot have been a traded item. That this material represents trade goods is thus excluded, for there was simply no market for it here. In the mainland zone of the Carolingian and Ottonian realms simple jewellery was likewise not traded but rather, as is widely shown by archaeological evidence, produced at many local sites (Wamers 1994a:150).

The presence of Franks or Frisians is also suggested by the burial Ka. 259 at Kaupang, in which a woman was interred who had only one imitation coin brooch ("Pseudomünzfibel") and not the pair of oval (tortoise) brooches typical of a Scandinavian woman (Blindheim and Heyerdahl-Larsen 1995:63–4; Blindheim et al. 1999:53; Stylegar 2007:Catalogue). Given that in the 9th century sparsely furnished burials with, for instance, one brooch and a knife, are unknown in the Frankish homelands and are only to be encountered in Frisian and occasionally also in Saxon cemeteries, this is most probably a woman from the Lower Elbe region, Frisia, or the Middle Rhine area (cf. the distribution of imitation coin brooches in Schulze-Dörrlamm 1999:fig. 8).

On the other hand, the double grave in mound 1 at Lamøya (Ka. 203–4, Stylegar 2007:Catalogue) included the burial of a woman with a pair of oval brooches and a silver equal-armed brooch with both interlace and cruciform decoration, as well as a Thor's hammer amulet and other objects. The male burial also included a Carolingian winged spearhead (Blindheim et al. 1981:213–15 and pls. 55–9). The woman must have been a Scandinavian who wore a Continental type of brooch as well as the standard brooch-pair. This means that we have to accept that some of the Continental brooches found in the settlement area of Kaupang could have been lost by Scandinavian women, and so are not automatically evidence for the presence of Frankish or Frisian women.

While the mounts from Carolingian weaponry and riding gear testify to the presence of presumably armed and mounted men at Kaupang, the cross brooch (C52519/14951; Fig. 4.8.1), the fragmentary equal-armed brooches (C51519/14481 and 15960; Figs. 4.9.1–2), and the dress-hook (Fig. 4.11.1) are female dress-accessories. The cloaks of Frankish men were indeed also fastened with brooches, as is shown in contemporary portraiture and confirmed by written sources, but as of yet archaeological examples of normal and truly Carolingian (AD 750–900) brooch-types in male graves in the core area of the Carolingian realm are rare in the extreme, if known at all (Wamers 1994b:598–9; Spiong 2000:149–56; Thörle 2001:250–66). The equal-armed brooches from Kaupang were only some 40 mm long, but this falls within the known range of the Carolingian examples and they are not necessarily evidence for the presence of children. Why both of these intrinsically solid brooches were broken we cannot say; only that they had ended up as scrap due to be melted down. This might also be indicated by the fact that they were found in the northern sector of the area of excavation, where the lead pendants that were probably made in Kaupang were also found (cf. Pedersen, in prep.).

Apart from the gilt silver sword-belt mount (C52517/274; Fig. 4.1), which represents a "noble" class, the rest of the Continental items represent the everyday costume and its dress-accessories of the 9th century above all. Such copper-alloy, occasionally silver, dress-accessories are found in considerable quantities at the larger settlement sites of the Carolingian realm, for instance in towns such as Mainz, Wiesbaden and Trier, the *villa* of Karlburg, the settlement of Balhorn, and in trading sites such as Domburg, Dorestad and the international entrepôt of Hedeby at the southern limit of Denmark. Their original wearers cannot be attributed to a high social class. In Kaupang, we can identify these as traders and craftsmen: in other words as people who most certainly had no reason to put any great wealth on show by way of their dress.

For most of the objects, a definite identification of their precise provenance in the Carolingian realm is difficult, since we are dealing, within the highly uniform Frankish material culture zone, with widespread types. Insofar as the distribution maps of the various types of find from Kaupang do yield a reliable picture, it is one with a centre of gravity in northern France between the Rhine and the Seine basin, including the North Sea coastal region. This is particularly clear in the case of the double-ended dress-hook (C52519/28305; Fig. 4.11.1), which is a dress-accessory typical of West Frankish women, with its roots in the Gallo-Roman traditions. In the case of high-status precious-metalwork in the Insular style, there were evidently workshops and schools in the area north of the Alps, with Salzburg at the centre.

Inventory no.	Object	Metal	Find-context	Dating	Figure
Kaupang					
C52517/274	Sword-belt mount	Silver	Field surveys	780–820	4.1
C52517/1496	Strap-end (Acanthus)	Copper-alloy, silver	Field surveys	800–850	4.3
C52517/844	Strap-end	Copper-alloy	Field surveys	820–880	4.5.1
C52517/1724	Strap-end	Lead-alloy	Field surveys	820–880	4.5.2
C52517/867	Strap-slide	Copper-alloy	Field surveys	820–880	4.7.1
C52517/900	Strap-slide	Copper-alloy	Field surveys	820–880	4.7.2
C52519/14951	Cross brooch	Copper-alloy	MRE, later medieval plough-layer	800–850	4.8.1
C52519/15960	Equal-armed brooch	Silver	MRE, modern ploughsoil	790–850	4.9.1
C52519/14481	Equal-armed brooch	Copper-alloy	MRE, modern ploughsoil	750–900	4.9.2
C52519/28305	Double-ended dress-hook	Copper-alloy	MRE, SP II	750–900	4.1.1
Huseby					
C52518/1	Mount-fragment	Copper-alloy, gilded	Excavations	770–850	4.12.1

Table 4.1 *Continental finds from Kaupang (1998–2003) and Huseby (1999–2001).*

Still, the sword-belt mount (C52517/274; Fig. 4.1) could have been made in practically any other central place (for instance along the Rhine between Mainz and Dorestad) or in the eastern mainland (Karlburg, Paderborn). However, with all the caution due when so few finds are in question, the people from the Continent who were present in Kaupang seem for the most part to have come from Frisia or northern France. This is corroborated by the Carolingian heirlooms found in burials at Kaupang: both the imitation coin brooch from the woman's grave Ka. 259 and the total of five equal-armed brooches and the fragmentary pseudo-cameo brooch (see, most recently, Gaut 2006) are – on present evidence – principally found in the Frisian coastal area and northern France (see above). Altogether there is a relatively large amount of Frisian-Frankish dress-jewellery from the settlement area and the cemeteries of Kaupang, some of it from the burials of Scandinavian women, which provides evidence of intensive contact and exchange and even influence within the trading site of Kaupang.

The period of time in which the Continental objects were originally used was from c. AD 750 to 900 (see the individual accounts, Tab. 4.1 and Fig. 4.23). There is nothing later than the 9th century. Two pieces, the sword-belt mount (C52517/274; Fig. 4.1) and the fragmentary silver equal-armed brooch (Fig. 4.9.1), could well go back to the last two decades of the 8th century. A few items (the copper-alloy equal-armed brooch C52519/14481: Fig. 4.9.2; the clasp C52519/28305: Fig. 4.11.1) cannot be dated any more precisely than to within the period of 750–900. Four objects can be narrowed down to the period c.

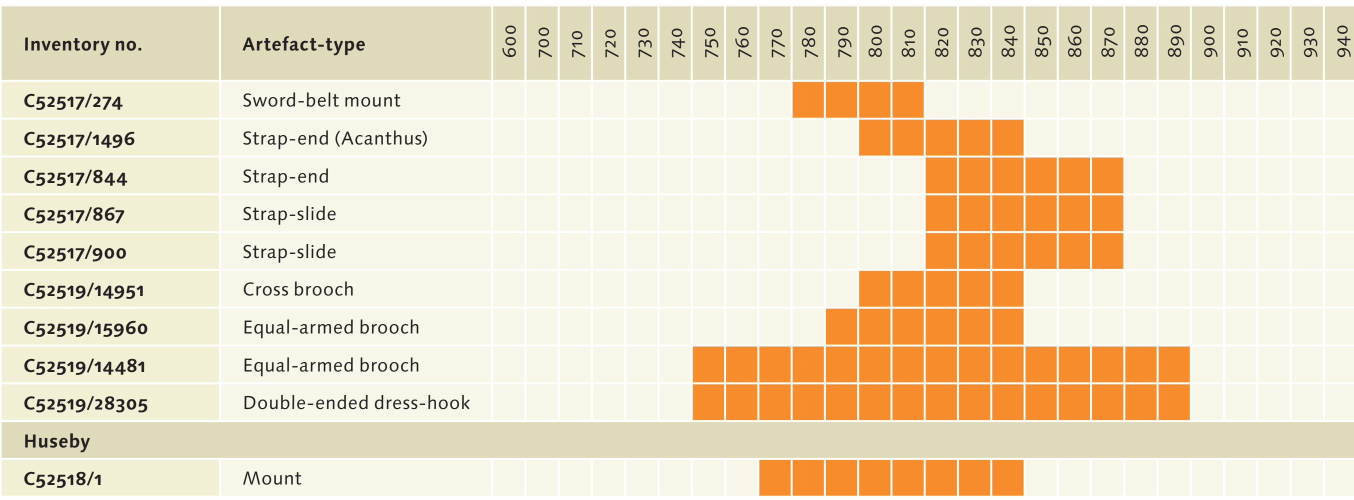


Figure 4.23 *Chronological chart of the Continental metalwork from Kaupang and Huseby.*

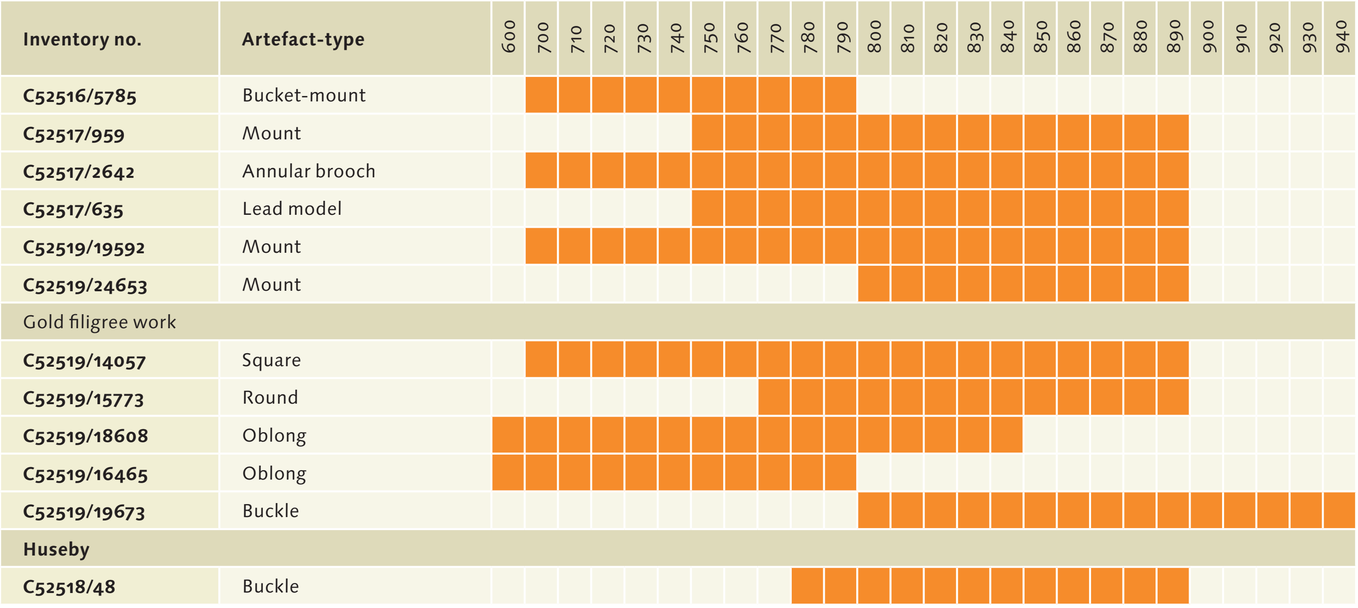


Figure 4.24 *Chronological chart of the Insular metalwork from Kaupang and Huseby.*

820–80, while three others are no later than the middle of the 9th century. There is a core period in the first half of the 9th century. However, we can only guess regarding the question of whether the Frankish objects may have remained in use in Kaupang beyond their normal functioning period, as is often the case with imported Continental material. Since, as already noted, these items had not been re-used, there is no evidence for an extended period of use beyond the 9th century. This observation is entirely congruent with the previous finds from the cemeteries.

The gilt copper-alloy mount (C52518/1; Fig. 4.12.1) from the excavations at Huseby must also be counted amongst the new finds of Continental metalwork. It appears to be an Early Carolingian/East Frankish product, and probably too a fragment of some liturgical object (see above, p. 80). Along with the Insular material from this site, this would fit in the context of the court of a chieftain with international contacts (see below, p. 93–5).

With the items of Continental metalwork from the most recent excavations at Kaupang, especially considered together with the finds made earlier in the cemeteries, this site is unique in Norway. In combination with the pottery, the glass and the weaponry, they give Kaupang a strongly Continental character which can only be explained through the site's function as a trading place. The range of finds also points firmly towards the region of Frisia/northern France, as is also the case at Ribe (Jensen 1991:13–23); the otherwise rich collection of finds from Hedeby is of less specific character. Considered in terms of the area of the MRE 2000–2002, a concentration of both excavated and metal-detected Carolingian finds appears in the north-eastern sector (Fig. 4.25); particularly so when the equal-armed brooches from Charlotte Blindheim's first excavation in the settlement are added in too. Three dress-accessories were found during excavation in Plot 3B, albeit in a disturbed overlying layer rather than in stratified contexts, or in the plot division ditch south-east of that plot (C52519/14481, /14951 and /28305; Figs. 4.9.2, 4.8.1 and 4.11.1). There is therefore every probability that women (and men?) from the Continent lived on this piece of ground and in this building, and since a total of three metal ornaments were lost there, it must have been a relatively long-term occupation, continuing for at least a few years (see Skre, this vol. Ch. 15:411–12, 16:431–4). If this distribution pattern is not just random, it is reasonable to suggest that this area could have constituted something like a "foreign quarter". The "Continental character" of this area is further strengthened by the small lead pendants of Carolingian type (Pedersen, in prep.), even if they were subsequently made here, as they were at other international trading places (Mainz, Domburg, Hedeby, Groß-Strömkendorf, York etc.).[12] We know that Frisian merchants of the 9th century lived in distinct "colonies" in international trading places such as Rome, Worms, Mainz, Andernach, Cologne, Duisburg, Dorestad, York and Birka, and were there to take part in markets and fairs. These "Frisian quarters" were consequently regularly found in convenient places at the landing places by the rivers, as, for instance, at Mainz ("… *optima pars Mogontiae civitatis ubi Frisiones habitabant…*": "…the best part of the city of Mainz, where the Frisians were living…". Rau 1992:127) and Cologne (Ellmers 1984:17–19; Lebecq 1998).

Inventory no.	Object	Metal	Find-context	Dating	Figure
Kaupang					
C52516/5758	Bucket-mount fragm.	Copper-alloy	CRM	700–800	4.13.1
C52517/959	Mount-fragm.	Copper-alloy, gilded	Field surveys	750–900	4.14
C52517/2642	Annular brooch fragm.	Copper-alloy	Field surveys	700–900	4.15
C52519/19592	Mount-fragm.	Copper-alloy	MRE, SP II	700–900	4.16.1
C52519/24653	Mount-fragm.	Copper-alloy	MRE, SP II	800–900	4.17
C52519/14057	Filigree, square	Gold	MRE, later medieval plough-layer	700–900	4.18
C52519/15773	Filigree, round	Gold	MRE, modern ploughsoil	770–900	4.19.1
C52519/18608	Filigree, oblong	Gold	MRE, SP II	600–850	4.20.1
C52519/16465	Filigree, oblong	Gold	MRE, SP II	600–800	4.20.2
C52519/19673	Buckle-fragm. (Insular?)	Copper-alloy	MRE, SP III	? 800–950	4.21.1
Huseby					
C52518/48	Buckle	Copper-alloy	Excavations	780–900	4.22.1

Table 4.2 *Insular finds from Kaupang (1998–2003) and Huseby (1999–2001).*

4.3.2 The Insular finds

The pieces of Insular metalwork from the excavated area of Kaupang discussed above are consistently of a more fragmentary condition than the Continental objects. With the probable exception of the mount-fragment C52519/24653 (Fig. 4.17) and the lead model discussed elsewhere (Pedersen, in prep.: C52517/635), these are small fragments of once much larger items. This is particularly the case with the barely 40-mm long foil strip from the mounts of a small Hiberno-Saxon liturgical situla (bucket) (C52516/5758; Fig. 4.13.1), the 17-mm long fragment of an annular brooch (C52517/2642; Fig. 4.15) and the tiny gold filigree-work fragments (Figs. 4.18–20). If the buckle-fragment (C52519/9673; Fig. 4.21.1) should also prove to be "Insular" or "Anglo-Scandinavian", that trend would be reinforced. This indicates that these objects had not been worn in the area excavated and lost there, but rather ended up there as the less attractive remnants of the Insular items originally imported – in other words, they were probably scrap metal. Even the filigree fragments (Figs. 4.18–20), the situla-fragment (Fig. 4.13.1) and the possible strap-slide (Fig. 4.17 – and lead model: Pedersen, in prep.), all show signs either confirming or at least suggesting re-use as brooches. This is consistent with the majority of Insular metal ornaments in Scandinavian contexts (cf. Wamers 1985:40–2, 1991b, 1998b:41–2). The persistently expressed doubt about the frequency and even the fact of Scandinavian re-working of Insular ornamental metalwork into brooches, pendants, weights and more (e.g. Blindheim 1977, 1978; Blindheim et al. 1999:48; Fuglesang 1989) derives from a deficient assessment and knowledge of the finds themselves and their evidence and is demonstrably wrong (Wamers 1991b). It is now continually being disproved by the stream of new finds from Norway and Denmark.[13]

The Insular fragments appear overwhelmingly to be remnants of secular objects. We could only identify, with any certainty, the situla-binding fragment (C52516/5758; Fig. 4.13.1) and probably also the possible fragment of a reliquary mount (C52517/959; Fig. 4.14), as ecclesiastical. In the absence of a fine chronology for Insular metalwork, these can only exceptionally (for instance with the situla-mount from the 8th century) be dated any more closely than within the broad period AD 700–900 (cf. Tab. 4.2 and Fig. 4.24). Any closer determination of provenance is also difficult. It is, however, a matter of interest that the excavations of 2000–2 did not produce the Anglo-Saxon metalwork that had otherwise been well represented at Kaupang (Blindheim in Blindheim and Heyerdahl-Larsen 1999:47–53). If it can be confirmed that the finds from the excavated area are in no case any later than the 9th century, the long period of use undergone by the pieces of Insular metalwork implies that they can hardly have been made in the West any later than c. AD 850.

12 Not far from the "Continental" plot 3B, at the northern end of plot 4B, the Xristiania-Religio denar was found in an undisturbed context: Blackburn 2008:56-7, 62.

13 The most recent finds have been listed in Wamers 1991b and 2004:57–8. It is interesting that no such doubt has been so vehemently expressed with regard to the "imported" Carolingian silverwork.

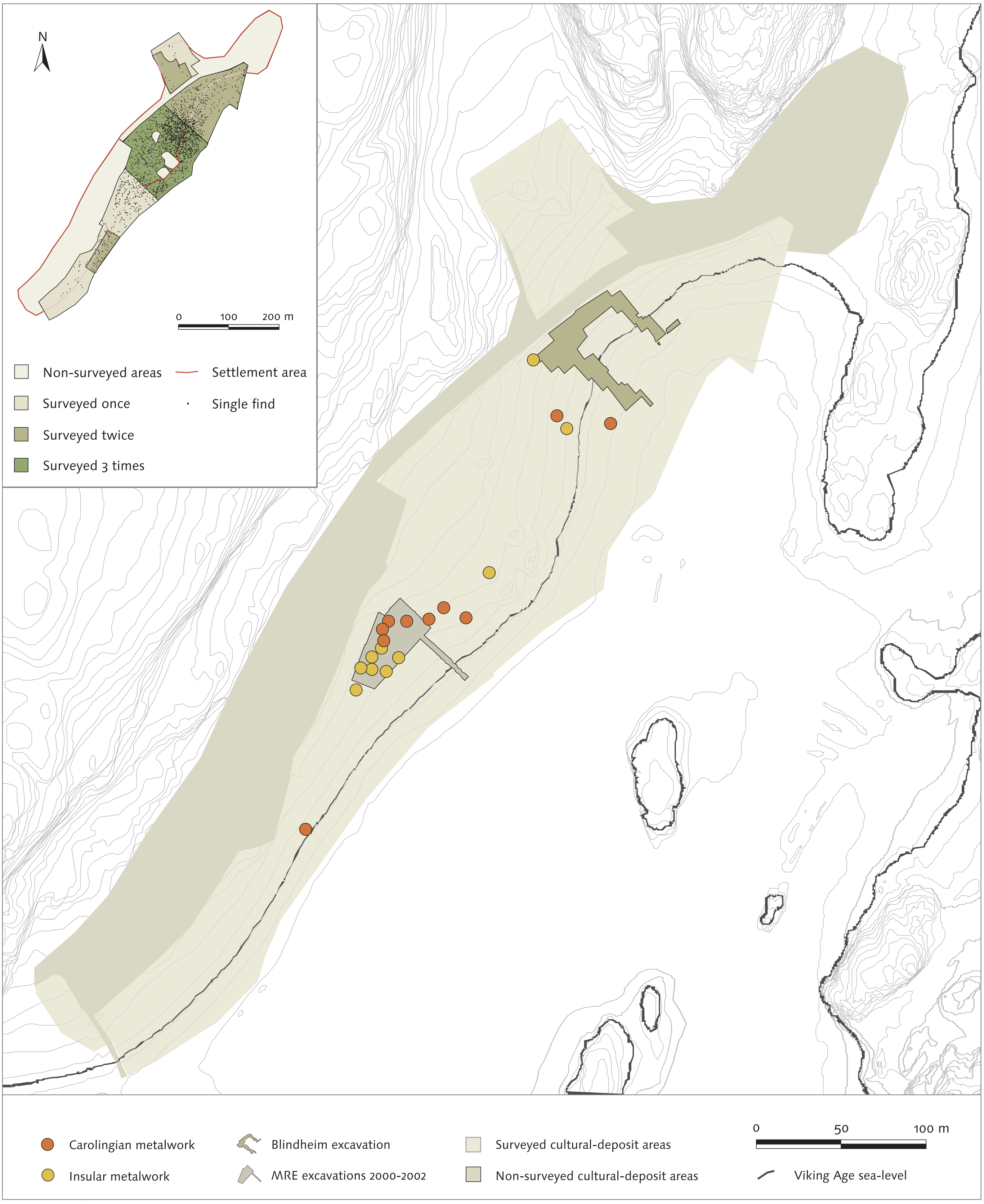


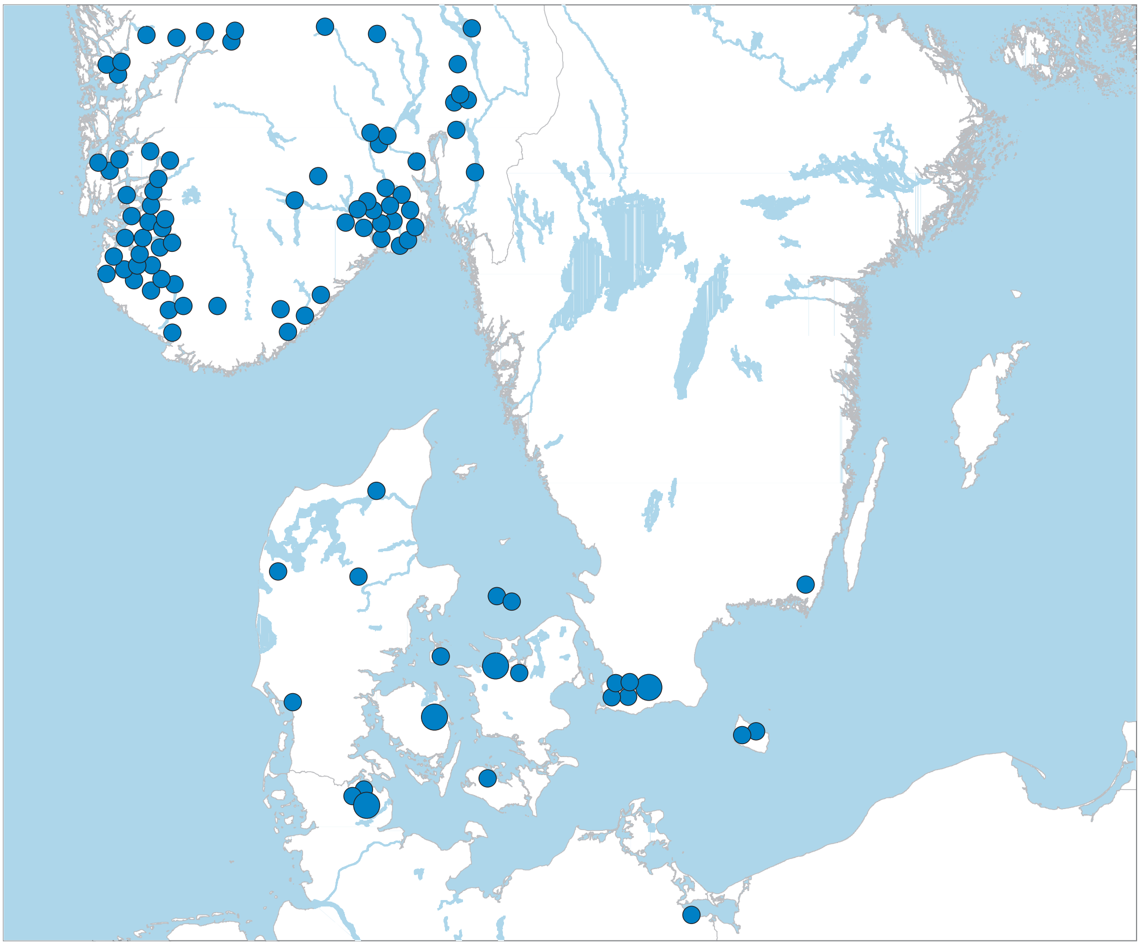
Figure 4.25 *Distribution of Carolingian and Insular finds from the fieldwork at Kaupang 1998–2003. Counter interval 1 metre. Map, Elise Naumann.*

In their re-worked form in Kaupang, these were women's dress-accessories, for such metalwork is also found more frequently in female graves at Kaupang (Blindheim in Blindheim and Heyerdahl-Larsen 1999:47–53). The fragments from the excavated area may, therefore, represent the erstwhile dress jewellery of the inhabitants of Kaupang, as well as heirlooms which came to the town from either the immediate neighbourhood or further afield. It is, however, an interesting fact that the Insular metalwork is concentrated in the south-western sector of the area of excavation, especially on plot 1A and its midden area towards the sea (Fig. 4.25). Taken with a pinch of salt, one can thus see a division between "Continental and Insular zones" (Skre, this vol. Ch. 16:431–2 and 437–8). Almost exactly on the border line between these two zones there also lay three Hiberno-Norse ringed-pins, a fact which for now eludes any conclusive interpretation (Graham-Campbell, this vol. Ch. 5). The three minute gold filigree fragments and the lead model were also found in the southern half of the area excavated. The small gold filigree appliqués are derived primarily from Irish or Hiberno-Saxon silverwork: splendid penannular brooches and/or liturgical items, which were fragmented in Kaupang itself (or arrived already broken up?) – whether because they had no use as ecclesiastical objects, or because they were old-fashioned silver brooches which were dismantled for the material to be melted down. Consistent with the latter is the fact that the Insular lead model, which very probably was itself associated with metalworking – indeed specifically the production of Insular metalwork also came from this south-western "Insular zone". However this model does not provide conclusive evidence that an Insular goldsmith was at work in Kaupang, or that it was used here for the production of Insular metalwork. Many lead models have been found far from the area of distribution of the finished products (Wamers 1998d). In any case, this area is less likely to have been an "Insular quarter" in an ethnic or cultural sense, rather a workshop zone.

The Irish belt buckle (C52518/48; Fig. 4.22.1) from the excavation at Huseby must also be counted in with the new finds of Insular metalwork, while the gilt copper-alloy mount (C52518/1; Fig. 4.12.1) is Early Carolingian (see above, p. 79–80 and 87–88). Alongside these were also found a "Hiberno-Norse" ringed pin and sherds of exclusive Continental pottery and drinking glasses. With good reason, Dagfinn Skre regards Huseby as the lordly seat of the "governor" or "Chieftain" of the royal trading site of Kaupang, the ancient "Skiringssal" (Skre 2007e). The imported objects identify the lord(s) of this hall as men who operated on an international stage, who wore Insular belts and cloak-fasteners (perhaps the Insular cloaks themselves: cf. Wamers 1998b:38), and whose tables were set with valuable imported bowls and cups. Their trans-regional connexions were undoubtedly based first and foremost on the trading that was stimulated by and controlled through the emporium of Kaupang. However we can well imagine that the lords of Huseby/Skiringssal also took part in military campaigns to the West and the South from Vestfold – like the attack upon and plundering of Nantes at the mouth of the Loire on 24 June 843 by 67 ships of the "Westfaldingi" (Vogel 1906:90–5; Dolley 1963; Wamers 2002:245).

Contrasted with the relatively low number of Insular finds from the Kaupang excavations and surveys of 1998–2003, the haul of earlier finds from the settlement and the cemeteries at Kaupang, at twenty items, is very high (summarized by Blindheim in Blindheim and Heyerdahl-Larsen 1999:47–52). These include genuinely Anglo-Saxon objects. This is fully double the quantity of Continental jewellery from the earlier excavations, to which, however, imported pottery, glass, beads and swords can be added. Some of the graves at Søndre and Nordre Bikjholberget contained both re-worked Insular mounts and further imported objects both Insular and Carolingian (Ka. 298, Ka. 304, Ka. 305 and Ka. 264). In other words, those who were buried in these cemeteries had an international appearance, and had access to "imports" from both the West and the South. This was undoubtedly a reflex of their function at the trading site of Kaupang, be that as merchants, governors, or the protective military force – along with their womenfolk.

The function and historical context of the Insular metalwork in Scandinavian contexts has been keenly debated over the last 45 years (Bakka 1963, 1993; Blindheim 1977, 1978; Blindheim et al. 1999; Wamers 1985, 1991, 1998). The present author has emphasized on various occasions that the majority of it had been plundered from Ireland and Britain and thus was the result of the Viking raids in the West. Charlotte Blindheim, in contrast, always argued, most recently in her comprehensive study of the grave-finds from Kaupang (Blindheim et al. 1999:47–52), that the Insular metalwork had rather arrived in Norway as "second-hand" trade goods and was broken up further there. The great frequency of this category of finds at the trading site of Kaupang was crucial to her argument, which the present author sought to explain in terms of there being readier access to such "loot" at an international emporium of this kind, while the people who visited and mingled, and were also buried here, were inevitably active in both trading and raiding in the West. Compared with the number of graves, as at Birka, the frequency of "imports" may seem relatively low – especially set against the known grave-finds rich in imported Insular objects such as those at Setnes, Skei, Gausel and Oseberg. Attention was also drawn to the connexion between trading and



raiding reflected in Old Norse literature (Wamers 1985:60, 1998b:44). The extent of any secondary trade in "Insular ornaments" was considered minor.

In the last twenty to thirty years, the distribution map of Insular jewellery in southern Scandinavia has changed significantly as a result of numerous metal-detector finds (Wamers 1998b:49–51, 2004: 43–6). While in Old Denmark, in present-day Denmark and south-western Sweden, there had previously been hardly any finds of this kind, because of the lack of grave goods, this region has now become an increasingly dense find-zone for decorative Insular metalwork (Fig. 4.26).[14] As in the case of the finds from Norwegian graves, these (largely) stray finds from Denmark for the most part comprise mounts re-worked as either brooches or weights. Above all, it is newly discovered central places such as Tissø and Uppåkra and the continuing work at Hedeby that have yielded copious amounts of new finds. These provide evidence that the wearing of re-worked decorative Insular metalwork extended far beyond Norway, and was common practice for these people. In the larger, central settlements, distinctively characterized above all by international trade and contacts, this exotic jewellery circulated in quantity. The women's graves found along the fjords of Norway – occasionally the men's too – with rich, diverse, Insular metalwork, sometimes with undamaged reliquary shrines, liturgical situlae, sprinklers and other ecclesiastical items, are still regarded by the present author as direct reflexes of the military activities of the then leading families. Such rich caches of exclusive Insular material in graves such as Setnes, Skei, Gausel and Oseberg cannot really be explained without the direct involvement of the families in the western Viking expeditions.

All the same, it seems to stand out ever more clearly, that the "second-hand trade" in "Insular ornaments" favoured by Charlotte Blindheim was more extensive than the present author had hitherto believed. The wearing of fragments of Irish and Anglo-Saxon metalwork, both secular and ecclesiastical, re-worked into brooches, was evidently widely

14 Distribution of Insular metal ornaments in southern Scandinavia, after Wamers 2004:57–58 (liste 4), fig. 2, with the following supplements: Sorte Muld, Bornholm, DK (NM C34367–70); Stavnsager, Jutland, DK (pers. comm. K. Høilund Nielsen); Stødov, Jutland, DK (pers. comm. K. Høilund Nielsen); Lamøya, Vestfold, NO (pers. comm. Steinar Kristensen).

Figure 4.26 *Distribution of Insular metal ornaments in southern Scandinavia (see footnote 14). Large symbols indicate two or more finds. Map, Elise Naumann.*

en vogue with the population of western Scandinavia. A certain magical significance attributed to these foreign objects may have been at play here (Wamers 2004:46). This does not, however, alter the fact that the overwhelming majority of the material, especially the fragments of ecclesiastical metalwork – but also to some extent the hanging bowls and penannular brooches too – never constituted primary objects of trade, but were booty from the churches and cloisters of Britain and Ireland. To this extent, these finds also reflect, in various ways, the Scandinavian Viking raids. In this context we must also take account of the hoard containing many fragmented "ecclesiastical metal ornaments" from the River Blackwater at Shanmullagh in Northern Ireland, close to the monastery. This was quite clearly "the stock-in-trade of a Hiberno-Viking metalworker who met with a misadventure on the river" (Bourke 1993:24); in other words, of a Scandinavian man who was either a craftsman or a merchant, if not both, while the mass of these fragments were the haul of one or more raiding expeditions, probably from the plundering of the monastery of Armagh by the Dublin Vikings in 895 (Bourke 1993:24–6; Wamers 1998b:42–3). In this context, it is a secondary question whether this was the deliberate hoarding of metal or a loss suffered while crossing the river. When and where the further re-working of such plunder took place, and in what portions it was eventually distributed to Viking recipients in Scandinavia and in Ireland or Scotland – and even through which market places – cannot yet be determined.

One thing, in any event, is becoming clearer and clearer: the whole corpus of the diverse Insular and "Hiberno-Norse" groups of imports – mounts reworked into brooches, various bronze bowls including tableware, balance-pans, bridle-mounts, belts, penannular brooches and ring-pins – together with their Scandinavian imitations (especially a variety of ring brooches: cf. Graham-Campbell 1984) led to the creation of a strongly marked "Insular milieu", particularly in Norway and to a lesser degree in Denmark, which had a definite and lasting influence on the daily life and the mentality of the Scandinavian population (cf. Wamers 1998b:38).

Considered against the "division" in the excavated area at Kaupang, the question then arises of whether here – assuming that we are not dealing with a purely random distribution – two separate groups of traders in defined "quarters" or housing can be seen: in one Frisians and/or Franks, and in the other Scandinavians who concentrated on the trade in Insular products, of which the re-working of booty formed a part.

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Pins and Penannular Brooches 5

JAMES GRAHAM-CAMPBELL

The fragmentary remains of two brooches and two pins among the newly discovered material from Kaupang, including Huseby, display "Insular" characteristics (both Pictish and Irish), although none of them is likely to have been a direct import into Norway, where they were most probably manufactured. In addition, two brooch terminals, consisting of polyhedral knobs, which are of Eastern origin, are also considered here. The Western penannular brooch- and ringed pin-fragments are considered in the light of the earlier Kaupang finds of such Insular metalwork, as previously presented by Charlotte Blindheim, and of the evidence for the possible manufacture of some of them at Kaupang itself.

5.1 Terminal fragment from a penannular brooch

C52519/19674 (Fig. 5.1) This brooch-fragment is badly corroded and the end of the extant terminal is missing. The remains of the hoop are circular in cross-section, tapering to a flattened sub-triangular terminal. This has an irregular outer edge and a central sub-triangular panel containing four ring-and-dot stamps (visible on X-ray). There are faint traces of a further ring-and-dot stamp outside this field of ornament, by the outer edge of the terminal, which is to be interpreted as the eye of an animal-head in profile. The reverse is plain. Length: 48 mm.

At first sight, this corroded copper-alloy fragment of scrap metal, from a dump layer on Plot 3 in the MRE, is an unpromising object for identification, other than that it was cut from a brooch-terminal (C52519/19674). It has, however, been possible to identify it beyond reasonable doubt, through X-ray assisted examination, as a further specimen from Norway of a penannular brooch with profile animal-head terminals (Graham-Campbell 1987:group I,E), copying "the Pictish type of animal-headed brooch from St. Ninian's Isle and Freswick … with the characteristic addition of stamped ornament" (Graham-Campbell 1987:237). Previously, only five such examples were known, one of which is from Denmark (Vang Petersen 1991:189 with fig.), with the other four all being from western Norway (Graham-Campbell 1987:237–8, 244 and figs. 6–8). One of the latter provides an exceptionally close parallel for the Kaupang fragment, allowing its ornament to be fully reconstructed (Fig. 5.2); this brooch is a single find (St1052) from Ferkingstad, Karmøy, Rogaland (Wamers 1985:111, list 1, no. 15, pl. 36.2; Foldøy 1995:158–9, no. 548).

Both the Karmøy and Kaupang brooches have a plain hoop expanding to a sub-triangular plate-shaped terminal, with an irregular profile to the outer edge and a panel containing ring-and-dot ornament, which represents the animal's cheek. What appears to be a single ring-and-dot stamp, outside this decorative field, on the outer edge, is to be interpreted as the animal's eye, by parallel with the better executed animal heads on the brooch from Spissøy, Bømlo, Hordaland (B11377), which also demonstrates that the irregular profile of the outer edge has its origins in the animal-head's protruding mane, ear and forehead; in this instance the animal's head is filled with hatching (Graham-Campbell 1987:fig. 7). The finest surviving example of a Group I,E penannular brooch is that from Sognefjell, Luster, Sogn og Fjordane (B11224), which has the same recessed cheek-panel as the Karmøy and Kaupang brooches, but in this instance it is plain, with the ring-and-dot ornament disposed around it (Wamers 1985:no. 8; Graham-Campbell 1987:fig. 6). This use of a recessed cheek-panel is also shared with the open-jawed animal-heads on the single-find of a complete brooch hoop from Neder Hornbæk Enge, in Jutland (NM I 6729/88). Whereas both the Sognefjell and Karmøy brooches have a double moulding marking the junction of the hoop with the

Figure 5.1 *Copper-alloy penannular brooch terminal from Kaupang. Insular style (C52519/19674). (Scale 1:1).Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 5.2 *Copper-alloy penannular brooch, with animal-head terminals, from Ferkingstad, Karmøy, Rogaland (St1052). Photo, Archaeological Museum, University of Stavanger.*

terminal, as does the example from Denmark, and that on the brooch from Spissøy is triple, this feature is clearly lacking from the Kaupang fragment. It also seems to have been present on the one other example of this brooch-type remaining to be mentioned, that from Brekke, Høyanger, Sogn og Fjordane (B8436); however, although this was clearly complete on discovery, it is now in an even more corroded state than the Kaupang fragment (Graham-Campbell 1987:fig. 8).

It may be suggested therefore that the 9th-century brooch from which this Kaupang fragment (C52519/19674) was cut, thus reducing it to scrap metal, will have travelled there from its most probable area of manufacture in western Norway, where examples of actual Pictish brooches have been found (Wilson 1971:90, nos. 27–31), although the animal-headed variety is not yet represented amongst them.

5.2 Pinhead-fragment from a ball-type penannular brooch

C52517/2518 (Fig. 5.3) This poorly preserved ball-shaped pinhead has been cut away from its pin. It has a corroded surface from being in the plough-layer, but is apparently plain. It has a circular pin-top projection, but no side collars. Height: 17 mm; diameter: 13 mm; width: 10 mm.

This copper-alloy fragment recovered from the plough-layer at Kaupang is the pinhead of a small penannular brooch that has been cut away from its shaft, reducing it to a piece of scrap metal. It is apparently plain, as might be expected from its small size and simple form, having a circular pin-top projection, but no side collars, although the surface corrosion makes it difficult to be certain (cf. Petersen 1928:fig. 206; Graham-Campbell 1987:figs. 11–12).

It is possible that this Kaupang fragment might have formed part of a failed casting, cut down for recycling, given that the site has produced good evidence for the casting of such small ball-type brooches. Part of a stone mould for a brooch-pin with a plain globular head was found during Blindheim's settlement excavations; this is of imported siltstone and would seem to have been broken during manufacture, never having been used (Blindheim 1969:19, fig. 8, 1976:19n20; Blindheim et al. 1999:39; Graham-Campbell 1980:127, no. 426). In addition, there are two recent finds from Kaupang of fragmentary lead models for pinheads (C52517/673 and C52519/15707), which also have no contexts, being likewise from the modern plough-layer (Pedersen, in prep.).

In a previous paper (Graham-Campbell 1987: 238–42, figs. 11–13), I classified the ball-type penan-

Figure 5.3 *Copper-alloy pinhead-fragment from a ball-type penannular brooch, from Kaupang (C52517/2518). Photo, Eirik Irgens Johnsen, KHM.*

nular brooches found in Norway as my Group III, dividing them into three sub-groups (A–C) on the basis of the decorative treatment of their ball-shaped terminals (as first proposed in Graham-Campbell 1984:32):

A. The thistle-brooch with ball-shaped terminals that are wholly or partially covered with cross-hatched and/or punched ornament known as "brambling".
B. Brooches with ball-shaped terminals that are plain.
C. Brooches with ball-shaped terminals that have a flat circular field, or roundel, on the front containing an ornamental motif.

Given that the new Kaupang pinhead-fragment (C52517/2518) is plain, it forms an addition to Group III,B. The manufacturing evidence for ball-type pinheads at Kaupang suggests the production of such Group III,B brooches (the simplest version, being completely plain), but it is of course possible that the terminals of some of these brooches may have been decorated in the manner of Group III,A, as is the case with the single find of a brooch from Måren, Attrå, Tinn, Telemark (C11285). Indeed, the three ball-type brooches excavated earlier at Kaupang are apparently all ornamented (Blindheim 1976:19, fig. 15; Blindheim et al. 1999:39). These consist of the remains of two small thistle-brooches (Group III,A), given that, despite the corrosion of brooch from grave Ka. 128 being such as to obscure any terminal decoration, there do appear to me at least to be traces of a cross-hatched lozenge on one side of its pinhead (Blindheim et al. 1981:221–2, pl. 85a). More elaborate is the brooch from a cremation grave (Ka. 151; Blindheim et al. 1981:pl. 43.5): this belongs to Group III,C, its three balls not only bearing the remains of triquetra-filled roundels, but also being further decorated with Borre-style interlace, including a ring-chain motif.

The smaller of the two thistle-brooch fragments from Kaupang is a settlement-site find, with only one terminal surviving, cast together with its hoop (Blindheim 1976:fig. 15, upper right). It is closely related in size, form and decoration to a brooch-fragment from Hedeby grave 276 (Capelle 1968:106, no. 89, pl. 25.2), and to a terminal from a boat-grave at Nes, Kvelde, Hedrum, Vestfold (C12488), seemingly reworked for secondary use as a weight (see below). In turn, these are closely paralleled by four equally small thistle-brooches from western Norway: Bjørkenes, Suldal, Rogaland (St7975); Fosse, Mæland, Alversund, Hordaland (B4253; Petersen 1928:fig. 208); Seim, Årdal, Sogn og Fjordane (C1783; Fig. 5.4); and Bale, Balestrand, Sogn og Fjordane (B465a). These four brooches share a distinctive method of manufacture, which is rare amongst other ball-type brooches, in that the pinhead has a split top so that it could be fitted around the hoop, which was cast as one with its terminals (cf. Fig. 5.4). It would seem likely therefore that Blindheim's thistle-brooch fragment from her settlement excavations at Kaupang, with its integral cast terminal, would likewise have had a split-headed pin.

It is therefore of particular interest that the two lead pinhead models from the Kaupang excavations are both of this split variety, and both are plain (Pedersen, in prep.), given that just such a plain ball-type brooch, of equivalent size, is known as a 19th-century single find from Larvik, Tjølling, Vestfold (T761; Rygh 1871:75–7, no. 761). In this instance, the split pinhead is socketed for the insertion of the pin itself, as is also the case with the plain split pinhead from a male grave at Hundstad, Hole, Buskerud (C19756).

This specific manufacturing feature is therefore suggestive of links between the metalworkers of western Norway and of Vestfold. As far as brooch fashions are concerned, it is relevant to note that Rogaland and Vestfold have produced some 45% of all the provenanced ball-type brooches so far known

Figure 5.4 *Copper-alloy thistle brooch from Seim, Årdal, Sogn og Fjordane (C1783). Photo, Eirik Irgens Johnsen, KHM.*

Figure 5.5 *Copper-alloy loop-headed ringed pin from Huseby (C52518/255). Photo, Eirik Irgens Johnsen, KHM.*

Figure 5.6 *Bone pinhead with iron ring from Kaupang (C52516/4093). Photo, Eirik Irgens Johnsen, KHM.*

from Viking-age Norway (more or less equally divided between them).

The thistle brooch originated as a native Irish brooch-type during the second half of the 9th century, and, at present, there are no apparent grounds for revising my previous conclusions (Graham-Campbell 1987:240):

> All the evidence points to the ball-type brooch (Group III) having been introduced into Norway at the end of the ninth century, or *c.* 900, when the silver prototypes began to be copied, not only in silver but also in bronze or iron, often coated with white metal to imitate the silver examples more closely. The evidence of both coin-hoards and grave finds shows that III,A and B brooches in Norway represented a widespread male fashion for an Insular form of cloak-fastener during the first half of the tenth century.

It seems highly probable that the two ball-type brooches from Hedeby (one of which is unpublished), as also that from a grave in the nearby cemetery at Thumby-Bienebek (Müller-Wille 1987:54–5, 119, pls. 67.8 and 96.5), were manufactured at Kaupang, given that only one example of a GroupIII,A/B brooch is known from modern Denmark (from a grave in the cemetery at Lejre).[1] It may also be proposed that the only two Group III,A/B brooches found at Birka (graves 905 and 914: Arbman 1940–3:pl. 47) likewise originated from Norway, and thus most probably from Kaupang (Graham-Campbell 1984:32).

Finally, it remains to be added that Group III,C brooches (a 10th-century variant) are “known only from Scandinavia and Russia” (Graham-Campbell 1987:240), and to point out that the Kaupang example (from grave Ka. 151) is standard in having Borre-style ornament on its balls, along with eight out of the other ten examples known from Norway (Graham-Campbell 1987:242).

This copying of Insular brooch-types in Norway is further illustrated at Kaupang by a distinctive penannular brooch (Group I,A from grave Ka. 297) from Charlotte Blindheim’s excavations. In the 1976 publication, Blindheim wrote that the brooch was made of silver but in 1995 she corrected this to being lead/iron/tin (Blindheim 1976:19, fig. 14; Blindheim et al. 1995:25, pl. 14yy; Stylegar 2007:Catalogue). Having previously discussed its form and ornament (Graham-Campbell 1987:235–6, fig. 3), it remains my opinion that:

> The simplified form of the Kaupang brooch, and the fact that it is truly penannular, suggests that we are dealing with a Norwegian remodelling; that it is based on an Irish pseudo-penannular seems to be confirmed by the fact that it has the elaborate Irish form of composite pin with closed loop, although in this it is unlike all other Norwegian copies of Insular brooch-pins.

1 (Note added in press) A second ball-type brooch (Group I, A) has recently been found in Denmark, at Randlev, near Odder, in Østjylland (Skalk, 2010:5:14).

5.3 The plain loop-headed ringed pin from Huseby

C52518/255 (Fig. 5.5) This small pin, with its plain wrap-round head and plain ring, is of the loop-headed variety. The ring is substantial (diameter: 20 mm) in comparison with the slight pin which, despite corrosion, was probably never much longer. Length: 52 mm.

As established by Tom Fanning (1994:15–23), the plain-ringed loop-headed pin is the commonest variety of this widespread type of cloak-pin and has its origins in Ireland in the pre-Viking period. Its simplicity is such that it could readily be reproduced in iron, and the copper-alloy examples themselves vary considerably in the quality of their manufacture. Their simplicity also complicates the problem of distinguishing imports into Scandinavia from their Scandinavian copies (Graham-Campbell 1984:35–8; Thunmark-Nylén 1984; Fanning 1990:143, 1994:21–2, 2000). However, the particular combination of a large ring with a short pin, which has a relatively broad pinhead, as exemplified by the Huseby ringed pin (C52518/255; Fig. 5.5), is now thought to be indicative of Scandinavian manufacture. Indeed, the closest parallel for the Huseby pin, amongst the five ringed pins from Kaupang published by Blindheim (1976:20, figs. 16–17g), and subsequently discussed by Fanning (1988:nos. 118–22), has a characteristically Scandinavian row of ring-and-dot stamping down its short pin (Blindheim 1976:fig. 16f; Fanning 1988:no. 118).

In his unpublished PhD thesis, completed in 1988, Fanning catalogued 86 examples of this type of ringed pin from the Scandinavian countries (nos. 76-161), including Iceland and northern Germany. Of these, the following pins may be noted as being similar in their small size to that from Huseby (length: less than 90 mm), with likewise relatively large rings: Fanning no. 93 from Roldal, Hordaland (B459: single find); no. 97 from Ytre Onsøy, Lurøy, Nordland (T4282b: grave find, 10th century (?); Sjøvold 1974:36, L 148, pl.48b); no. 111 from Vaage, Rogaland (British Museum 1891,10-21,101: no details); no. 119 from Kaupang (grave find; Blindheim 1976:fig. 16a); no. 122 from Kaupang (grave find; Blindheim 1976:fig. 16g); no. 136 from Bargo, Gotland (SHM 3228: no details); no. 144 from Birka, Uppland (SHM Bj596: no details); and no. 158 from Hedeby, Schleswig (grave 133, now lost). Fanning has noted that "the dating evidence from Scandinavia suggests that the type did not continue in use beyond the tenth century" (1994:23).

By way of comparison, out of the 60 examples of plain-ringed loop-headed pins from the Dublin excavations published by Fanning (1994:nos. 3–62), only two of the complete copper-alloy examples (nos. 9–10) have pins shorter than 90 mm, with

small rings representing the norm.

In conclusion, therefore, the plain-ringed loop-headed pin from Huseby (C52518/255) represents one of the Scandinavian copies of the most basic type of Insular ringed pin, "adopted from the Irish by the Norse, probably sometime in the mid-ninth century" (Fanning 1994:21), and which were to remain popular into the 10th century. Given the three close parallels already recorded from Kaupang (as noted above), it seems likely that it was made there.

5.4 Bone pin-fragment with iron ring

C52516/4093 (Fig. 5.6) This broken bone pin was circular in cross-section, but its perforated pinhead is of flat spatulate form, a characteristic of pins shaped from pig fibulae. A simple iron ring (diameter: 26 mm) passes through the circular perforation; its corroded ends just overlap each other but probably would originally have been twisted together. Length: 38 mm.

The commonest type of bone pin manufactured during the Viking Period utilized the fibulae of pigs, with "the naturally flattened and expanded distal end form[ing] the head, the shaft of the bone being cut through to form a pointed shank" (MacGregor et al. 1999:1950). The heads of such simple pins were commonly perforated: cf. those from Hedeby (Schwarz-Mackensen 1976:41–2, fig. 16) and York (MacGregor et al. 1999:1950–1, fig. 909). The addition of small ring to the bone pin from Kaupang, in this case of iron, is an unusual feature, but not unknown, as can be seen, for example, on two bone ringed pins from York (Roesdahl et al. 1981:115, YAB40), and two of a different type from Hedeby with copper-alloy rings (Schwarz-Mackensen 1976:31, fig. 10.6–7). Such are evidently intended to imitate metal ringed pins and stick-pins (cf. the Vestfold type, discussed below).

This Kaupang bone pin-fragment (C52516/4093) is therefore undiagnostic chronologically, other

Figure 5.7 *Plain copper-alloy fragment of a pin tip from Kaupang (C52517/481). Photo, Eirik Irgens Johnsen, KHM.*

Figure 5.8 *Copper-alloy terminal knob from a penannular brooch, from Kaupang (C52517/70). Photo, Eirik Irgens Johnsen, KHM.*

Figure 5.9 *Copper-alloy terminal knob from a penannular brooch, from Kaupang (C52519/15513). Photo, Eirik Irgens Johnsen, KHM..*

than dating broadly from the Viking Period. Given its simplicity and general parallels, it could well have been manufactured at Kaupang.

5.5 Vestfold-type stick-pin

C52519/20381 (Hårdh, this vol. Ch. 3:Fig. 3.30) This pin is of the so-called Vestfold type, but lacking its ring. The pin is circular in section, with its tip missing. It has a needle-like, but waisted, pinhead, with an oval perforation; its main faces are crudely decorated with some transverse grooving, whereas its sides are plain. Length: 70 mm.

This copper-alloy pin, with perforated baluster-head, lacks its ring, but is to be identified as belonging to the so-called Vestfold type of stick-pin, identified by Charlotte Blindheim as being of local manufacture (1976:20, 22 and fig. 16b). Characteristically, this particular type of stick-pin has a small loop crowning a solid baluster head through which a thin ring is passed. The needle-like head of this particular example from Kaupang (C52519/20381) represents therefore a simple variant of the type, but it is important to note that it has the standard form of shank, circular in section for its entire length, just tapering to its (missing) point, unlike those of most penannular brooches and ringed pins (see below). However, given that Blindheim originally discussed these stick-pins together with the Insular, and Insular-style, ringed pins from Kaupang, this pin has been introduced briefly here if only to draw attention to its discussion by Birgitta Hårdh in the context of other such Scandinavian metalwork from the 9th and 10th centuries (Hårdh, this vol. Ch. 3; cf. Graham-Campbell 1995:157, S7, for two examples from Scandinavian Scotland).

5.6 Fragment of a pin tip

C52517/481 (Fig. 5.7) This plain pin-tip is flat in section and tapers to a point; it is broken across its other end. Length: 37 mm.

This fragment of a copper-alloy pin-tip from Kaupang has been selected for mention here so as to demonstrate that it is impossible to determine, from such small plain pieces, whether or not they are derived from Western-style brooches or ringed pins, either imported or manufactured at Kaupang. The important point to note is that this example is representative of most such types of brooch and pin because of being flat in section before tapering to its point, even though such pin-shanks may initially have a circular section before expanding to a rectangular one. The contrast can therefore be readily made with most stick-pins, with their characteristically circular-sectioned pin-shanks (as described above).

5.7 Two polyhedral terminal knobs from penannular brooches

C52517/70 (Fig. 5.8) This polyhedral knob has been cut from a brooch with a hoop of circular cross-section (diameter: 5 mm), a fragment of which remains on the underside of the terminal, from which it is upstanding. Its end-face is plain, but the other three side-faces each contain a single ring-and-dot stamp, as also seemingly on top. The knob is square-shaped: 12 x 12 mm.

C52519/15513 (Fig. 5.9) This polyhedral knob has only slight remains of its hoop on one end-face. It is in poor condition being from the plough-layer, but retains traces of a simple incised pattern on its upper face. This comprises a small circle at the centre of a linear cross that extends into the four corners, where it links with a line around the border. The other faces are plain. Length: 19 mm; width: 15 mm; height: 13 mm.

The import of Eastern penannular brooches (or so-called *Hufeisenfibeln*) into Norway during the Viking Age, and their subsequent influence on Norwegian brooch-fashions, was a topic long overdue for the reconsideration undertaken by Birgit

Heyerdahl-Larsen (1979) in the light of three finds from Kaupang. The only previous discussion of this material consisted then of a 50-year-old paper by Gutorm Gjessing (1928), together with the contemporaneous presentation of the finds by Jan Petersen (1928:186–90). In the meantime, however, their classification had inevitably been superseded by Helmer Salmo's study of the large number of such brooches from Finland (1956), in which he divided them into 26 groups (see now also Mägi-Lõugas 1994 for Estonian Viking-age penannular brooches and their decoration).

The three brooches from Kaupang discussed by Heyerdahl-Larsen (1979:figs. 1–3) are cemetery finds, one of which is from grave Ka. 272 (1979:fig. 1): this belongs to Salmo's group 7, characterized by having simple faceted knobs for terminals. The other two (from graves Ka. 8 and Ka. 278; Heyerdahl-Larsen 1979:figs. 2 and 3) are both from 10th-century graves and belong to Salmo's group 8, characterized by faceted knobs ornamented with four protruding pegs. However, as Heyerdahl-Larsen points out (1979:126):

> The Kaupang brooches, like several other south Norwegian specimens [the four listed on p. 117], have traits that set them apart from brooches found in the east, Sweden included. Such traits are: rows of pits on the hoop, incised dots on the knobs, knobs lacking facets and finally, long, straight often decorated pins, resembling ringed pins.

Two of the other brooches, both from Telemark, "not very far from Kaupang", are described by Heyerdahl-Larsen as being "almost identical with one of the Kaupang specimens (from Ka. 8) and have probably been made in the same workshop, perhaps by the same hand" (1979:127), which she goes on to postulate might well have been at Kaupang itself. It is of some interest therefore that there are now two such brooch-terminals amongst the recent stray finds from the plough-layer (one excavated and the other metal-detected). Before considering these, however, it is worth noting that there is a recent single find from northern Scotland of a further brooch belonging to Salmo's group 8, from near Harrow on the coast of Caithness (Batey 1993:159, fig. 6.9), which has the long pin identified by Heyerdahl-Larsen as being a southern Norwegian trait.

It is the case, however, that neither of the two new polyhedral terminals from Kaupang (C52517/70 and C52519/15513) belong to Salmo's group 8, the peg type just discussed. Both are simple faceted knobs (group 7), although they differ from one another in size and decoration. The upper face on the larger of the two (C52517/70) has a simple linear design, consisting of a cross within a border at the centre of which is a small circle (Fig. 5.8). Examples of complete comparable brooches include two from Birka, graves 1083 and 834 (Arbman 1940–3:pls. 55, 1a–b and 2a–b). The smaller knob (C52519/15513) has a single ring-and-dot on its upper face and on three of the four sides, the end one being plain because, facing the opposite terminal, it would not have been visible when the brooch was in use (Fig. 5.9). A good example of a complete comparable brooch is that from Birka grave 179 (Arbman 1940–3:pl. 54.2a–b).

These two Kaupang terminals (C52517/70 and C52519/15513), belonging to a common Eastern type of 9th-/10th-century brooch, therefore do not display the southern Norwegian traits identified by Heyerdahl-Larsen on seven of the twelve brooches of Salmo's groups 7 and 8, tabulated by her from Nord-Trøndelag and further south (1979:117). They are therefore to be counted as additional to the other five, representing the imported brooches which served as the models for the Norwegian variants, in this case reduced to scrap metal.

One further possibility remains, however: that one or even both of the Kaupang terminals might have been used as weights, in the manner perhaps of

Inventory no.	Object	Metal	Find-context	Dating	Figure
Kaupang					
C52519/19674	Terminal-fragment from a penannular brooch	Copper-alloy	MRE, AL68283 (refuse layer, Plot 3A)	800–900	5.1
C52517/2518	Pinhead-fragment from a penannular brooch	Copper-alloy	Field surveys	900–950	5.3
C52516/4093	Bone pin-fragment with iron ring	Bone, iron	CRM, plough-layer	800–1000	5.6
C52519/20381	Stick-pin	Copper-alloy	MRE, SP II	800–850	Ch. 3, 3.30
C52517/481	Fragment of a pin tip	Copper-alloy	Field surveys	800–1000	5.7
C52517/70	Terminal knob from a penannular brooch	Copper-alloy	Field surveys	800–1000	5.8
C52519/15513	Terminal knob from a penannular brooch	Copper-alloy	MRE, plough-layer	800–1000	5.9
Huseby					
C52518/255	Ringed pin	Copper-alloy	Excavation	850–950	5.5

Table 5.1 *Catalogue of pins and penannular brooches from Kaupang and Huseby.*

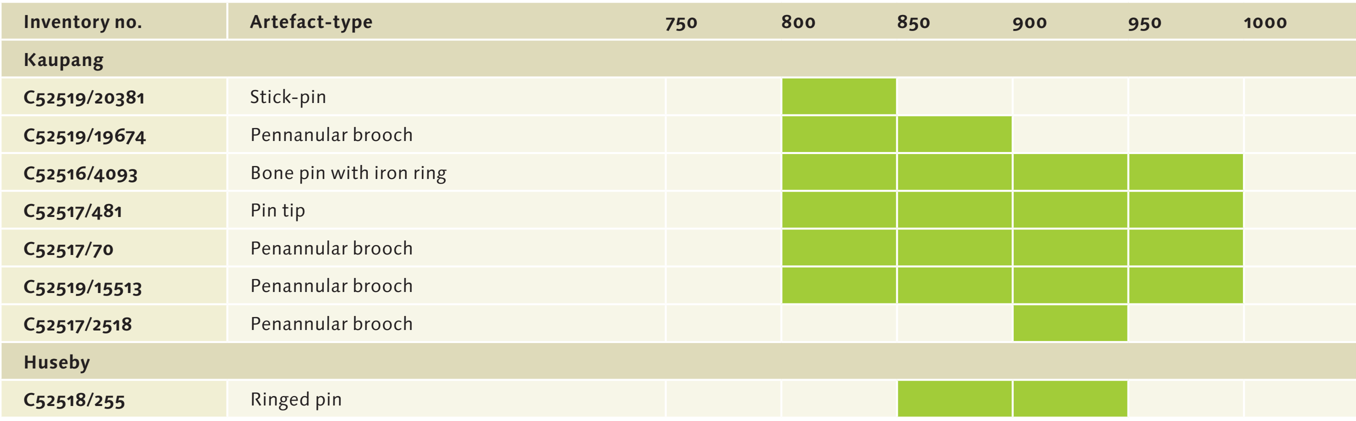


Figure 5.10 *Chronological chart of pins and penannular brooches from Kaupang and Huseby.*

the "knob of a penannular brooch, belonging to the type R675", from Nybø, Ofoten, Salten, as recorded by Sjøvold (1974:83, L342), along with another such detached knob of unknown provenance, although also from northern Norway (Sjøvold 1974:217). The Nybø knob was found in a leather pouch together with "eight weights, some of bronze, others of iron and bronze" (Sjøvold 1974:83), but as the only other object was "a bronze ingot", it is obviously an open question as to whether the knob belongs with the weights or with the ingot (as scrap metal). Finally, in any consideration of the possible secondary use of such brooch-terminals as weights in Viking-age Norway, it is necessary to recall the small thistle-brooch terminal from a boat-grave at Nes, Kvelde, Hedrum,Vestfold (C12488), mentioned above. This was discovered, with two actual weights and a hone, in the region where the buried person's hips would have been expected to be located in the boat. It seems highly probable therefore that this particular brooch-fragment, at any rate, had been reworked to form a weight, as originally suggested by the excavator, Nicolay Nicolaysen (1886:32–3).

Acknowledgements

I am most grateful to Dagfinn Skre for having invited me to undertake this study and to the members of the project staff who assisted me both in the examination of the material and in the preparation of this report. My background research has been carried out ever since becoming a graduate student in Norway in 1968, and it is impossible to thank all those who have assisted me with it over so many years. However, it is appropriate here to acknowledge the particular contributions of both Egil Bakka, who launched me into it, and Charlotte Blindheim, who was always a great encouragement to its continuation. Sir David Wilson, who guided it to completion, was amongst those who kindly commented on the first draft of my text to its considerable benefit.

Amber and Jet 6

HEID GJØSTEIN RESI

This study deals with the finds of amber from the fieldwork at Kaupang of 1998–2003 (N=c. 1,300), while the study of the jet and jet-like materials (N=23) also includes finds from earlier work at Kaupang. The closest natural sources of amber are around the southern Baltic, and thence across western Jutland, northern Germany and the Netherlands to the coast of East Anglia. Amber from this zone is referred to in scholarly literature as "Baltic amber". Finds of jet and jet-like materials in Viking-period Scandinavia are assumed to derive from the British Isles, particularly parts of Yorkshire.

Amber was also a favoured material for jewellery in Norway long before the Viking Period; jet, however, does not appear before then. From an examination of the quantities of finds, the object-types and the distribution of finds within the settlement area, and comparison with similar locations in trading sites that appear to be in the same network as Kaupang, some questions concerning the importation of raw material and the local working of amber and jet can be discussed. Special tool-marks on semi-manufactured artefacts and the distribution of production waste can provide further information on the character and extent of production.

Semi-manufactured items and objects broken during production show that amber was worked in Kaupang. A concentration of production waste on Plot 1A in SP II may represent a workshop area. Beads and several forms of pendant or amulet are present both in finished and unfinished states. Rarer items such as rings, a gaming-piece and an inlay may also be local products. In the case of a very high-quality foot-shaped amulet, however, it is not easy to determine if this was made on site. It was found in the possible workshop area, but was produced using a more advanced technique than the other amber artefacts.

Armrings form the major group amongst the finds of jet and jet-like materials from the settlement and graves. The majority of them have been split along the natural layering of the material, which has proved to be shale. There are also a few small rings, probably finger rings, and beads or spindle-whorls. Three pieces of raw material, one unfinished broken bead, and a semi-manufactured bead show that jet and jet-like materials were worked in Kaupang. There is reason to believe that most of the artefacts, especially the armrings, were imported as finished items. In the current state of knowledge, the closest parallels to the artefacts of jet and jet-like materials at Kaupang appear amongst the finds from Anglo-Scandinavian York.

6.1 Amber

From the earliest times amber was a sought-after material for jewellery and amulets over much of Europe. Evidence of Baltic amber in Mycenean graves, the account of a Roman trading mission arriving at the mouth of the Vistula at the time of the Emperor Nero in order to secure the supply of amber to the South, and finds of amber hoards along what are known as "amber roads" between the North and South of Europe, have influenced many scholars' views of the cultural historical significance of Baltic amber (Bohnsack 1976; Rottländer 1975). Nonetheless, access to amber and interest in making use of it varied greatly from period to period (Jensen 2000).

In southern Scandinavia, where raw amber was immediately available along many stretches of the coastline, amber starts to appear in archaeological finds from around 7000 BC. In what was later to be Norway, where amber practically never occurs naturally, this raw material also played some role. A few bog finds of well-made amber pendants and buttons

from the Neolithic in western Norway and North Trøndelag have been interpreted as reflections of cultural exchange or trade links with Jutland and Prussia (Brögger 1909; Shetelig 1922; Mandt 1988). A number of new finds of amber from neolithic settlements and graves from Vestfold to Finnmark fill the picture out (Østmo 1984; 1985; Lødøen 1993; Åstveit 2006; Ramstad 2006). As of yet, however, there are no finds of amber from the Bronze Age in Norway. Only in the Early Iron Age, especially in the Late Roman Period and the Migration Period, do amber beads appear regularly in graves. At the transition to the Later Iron Age, in the later Migration Period and Norwegian Merovingian Period, a declining taste for amber is apparent in Norway as in Scandinavia as a whole, although the reduction in the quantity of finds may also be due to the wider practice of cremation (Bohnsack 1976; Hansen 1997; Magnus 2003). In the Viking Period, amber then enjoyed a new lease of life, to become a prominent find-category at the newly established trading sites.

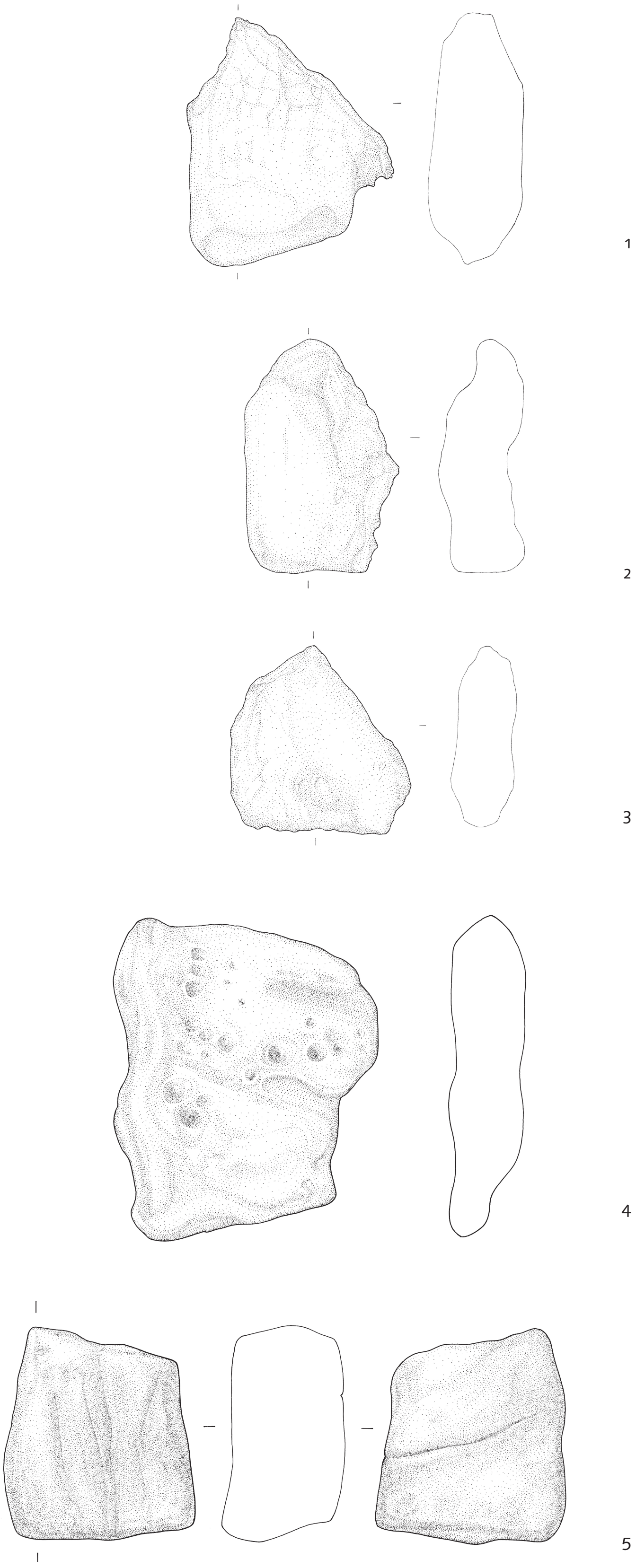
6.1.1 Baltic amber

Baltic amber is resin (*succinite*) from conifer trees that were growing in northern Europe 55 to 35 million years ago, in the Eocene (Kars and Wevers 1983b, and refs.). In that epoch, Fennoscandinavia (southern Sweden, southern Finland and the Baltic) were a continuous landmass which for some 15 to 20 million years was covered by what is known as "amber forest". The same was the case in adjacent areas of the eastern Baltic. Under the influence of ice and moving waters in succeeding eras, the deposits of amber were repeatedly moved around. The present distribution stretches from the coastal regions of the southern and central Baltic and thence across western Jutland, northern Germany and the Netherlands to the coast of East Anglia (Fig. 6.1). There are also outcrops inland in northern Germany and south of the Baltic through Poland to Russia. Amber from this whole zone is referred to in scholarly literature as "Baltic amber".

Various laboratory analyses of the provenance of amber from Viking-period settlements within the sphere of contacts of Kaupang have been carried out. Six items of amber from Dorestad and three from Hedeby were analysed by infrared absorption spectra and identified as Baltic amber (Kars and Wevers 1983b). Twenty items of amber from York have been analysed by infrared spectroscopy spectra and sixteen produced spectra agreeing with Baltic amber. The four that did not match were

Figure 6.1 *Areas with natural deposits of amber in Europe. The line marks the southern limit of the distribution of Baltic amber. After Kars and Wevers 1983b:fig. 141.*

Figure 6.2 *Raw amber from Kaupang with a few polished surfaces (1–3) and artificial furrows in preparation for cutting (4–5).* ***1:*** *C52519/20093;* ***2:*** *C53160/47;* ***3:*** *C52519/22419;* ***4:*** *C52519/14200;* ***5:*** *C52519/19612. Scale 1:1. Drawing, Bjørn-Håkon Eketuft Rygh.*



interpreted as indigenous or possibly imported to York (Panter 2000a). Five items of amber from Groß Strömkendorf have been analysed by gas chromatographic pyrolysis (PY-GC) and could be included in the category of Baltic amber (Gerds 2001a:19). Infrared spectra of 21 Iron-age amber items from Sweden also agree with the spectra of Baltic amber (Beck and Lipcan 1998). As of yet no scientific analyses of the amber from Kaupang have been carried out, but considering the proximity of the sources and the results of analyses summarized above it is overwhelmingly probable that this is Baltic amber.

6.1.2 Amber from the excavations of 1950–1974

In her account of the finds of raw amber and amber artefacts in a popular academic summary after seventeen seasons of excavations in the cemetery and settlement at Kaupang, Charlotte Blindheim attached particular importance to artefacts on which the surface treatment was manifestly unfinished (1969:17–18). Other features of the amber finds also convinced her that amber polishers had been at work in Kaupang. Some pieces of raw material were so large that they could not be considered to be pieces of broken objects, while others showed traces of working. Semi-manufactured items, including a small female figure, had, in her view "such an unmistakably Scandinavian stamp" that they must have been produced in Kaupang. The amber finds as a whole were interpreted as local products made from imported raw material.

Blindheim (1960) linked the female figure to a group of small modelled figures of jet and amber in Norwegian Viking-period finds. Human figures are rare. She drew attention to the trailing dress and the other similarities in form between this figure and Late Iron-age Scandinavian representations of women in various media. A parallel was an amber bead in the form of a woman found in a grave at Longva, Sunnmøre (B9471a).

Blindheim's work in the settlement area yielded 21 amber beads, while 28 amber finds (27 beads and one piece of amber) had come from her excavations of inhumation graves at Bikjholberget (Heyerdahl-Larsen 1999:67–8). The beads were evenly distributed between fourteen male and female graves, normally one or two in each grave, with four in just one single case (Heyderdahl-Larsen 1999:70, n.14). Birgit Heyerdahl-Larsen emphasized that the amber beads in male graves were often larger than those in female graves. The beads were annular, round, barrel-shaped and discus-shaped. Many of the beads were judged to be unfinished and irregular in form. The amber beads were found primarily in graves of the 9th century although there are some from the 10th century.

6.1.3 Amber from the excavations of 1998–2003

Approximately 1,300 pieces of amber were found 1998–2003 with a total weight of c. 300 g. Amongst these, 161 pieces can be counted as raw material. Probable production waste in the form of offcuts with cut-marks and bruising comprises 996 pieces. Unfinished beads and pendants make up 55 pieces (44 and 11 respectively). Of finished artefacts or fragments thereof, there are beads (52), pendants and amulets (3), rings (2), a gaming-piece (1) and a piece of inlay (1). A group of artefacts of unknown function consists primarily of unfinished and damaged items (31). A list of finished and semi-manufactured objects is provided in Appendix 6.1.

Raw material (N=161)

Unworked blocks of amber with the original patina preserved to a greater or lesser degree are counted as raw material. Most of these are quite small pieces, 4–20 mm along their maximum dimension, although there are a few measuring up to 50 mm (Fig. 6.2.1–5). Some of the raw material from Kaupang bears traces of cutting or striking, which may be either accidental or deliberate – in the latter case to test the quality and colour, or to divide the block. The majority of the pieces of raw material are dark mid-yellow or brownish, while only seven are honey-yellow or milky yellow. The impression of the very dark hues may, however, have been enhanced by the use of a dark conservational wash.

Production waste (N=996)

Waste from amberworking is a group of offcuts or splinters with a maximum dimension of 3 mm or more (N=503) or of smaller crumbs (N=493). The longest splinter is 51 mm but the majority are 3–10 mm long. The crumbs may also be fragments that have broken off from poorly preserved amber objects, but they appear mostly to be offcuts or waste produced by amberworking.

Unfinished beads (N=44)

Traces from the making of amber beads have been discovered at a series of trading sites such as Kaupang. In the case of Hedeby, Ingrid Ulbricht (1990:72–5) specifies the following sequence of tasks in beadmaking: the choice of suitable raw material; the division and shaping of the blank; the marking of a point for drilling a central hole; the drilling itself (which could be done on the raw blank), and the final surface treatment. Similar features have been emphasized as typical of various stages in the making of amber beads in York (Panter 2000b:2504–5). The amber finds from Groß Strömkendorf also reflect stages in the making of beads in the same way (Gerds 2001b:117–18, fig. 2). The same has been proposed for the making of amber beads at Paviken on Gotland (Lundström 1981:93–5).

From Kaupang, there are several plate-like pieces of amber, both naturally formed and manifestly cut, which one could believe were blanks for beads. It is difficult to prove this, and they are therefore treated as objects of unknown function.

One off-cut of honey-yellow amber and a lump of brownish amber with cut sides (Fig. 6.3.1) can be seen as blanks suitable for beads. There are three roughly round slices with knife-cut sides (Fig. 6.3.2–3) while more fully prepared and clearly rounded slices with more even surfaces number ten (Fig. 6.3.4–6). They range from 7 to 11 mm in diameter. Two very small specimens have a polished, rounded upper face and a flat underside (Fig. 6.3.7). These two are reminiscent of a round amber inlay from Charlotte Blindheim's excavations that is discussed below, and the association of these with the bead-blanks is uncertain.

On five very different blanks for beads, points have been marked which seem to show where the drilled hole was intended to be (Fig. 6.3.8–10). Marks of this kind occur, for instance, on a roughly formed blank with only one semi-smoothed surface, on a flat piece of raw amber, on an irregular lump of raw amber and on an unfinished but well-shaped round bead-blank that had snapped at this point (Fig. 6.3.11). The hole was formed by drilling from two sides with the aid of a soft drill which produced an hourglass-shaped channel. There are also more crudely formed holes. Such holes, which had been started from either side but not completed, are found, for instance, on one well-made unfinished bead (Fig. 6.3.12) and on an almost naturally shaped oblong plate (Fig. 6.3.13). It is clear that the drilling of the hole was a difficult task that often caused breakage. Fourteen bead-blanks had broken at this stage (Fig. 6.3.14 and 16–19). There are also at least six unfinished beads that had been successfully drilled but on which the final surface treatment was never carried out (Fig. 6.3.15). Two of the unpolished beads have signs of wear in the drilled hole and on the sur-

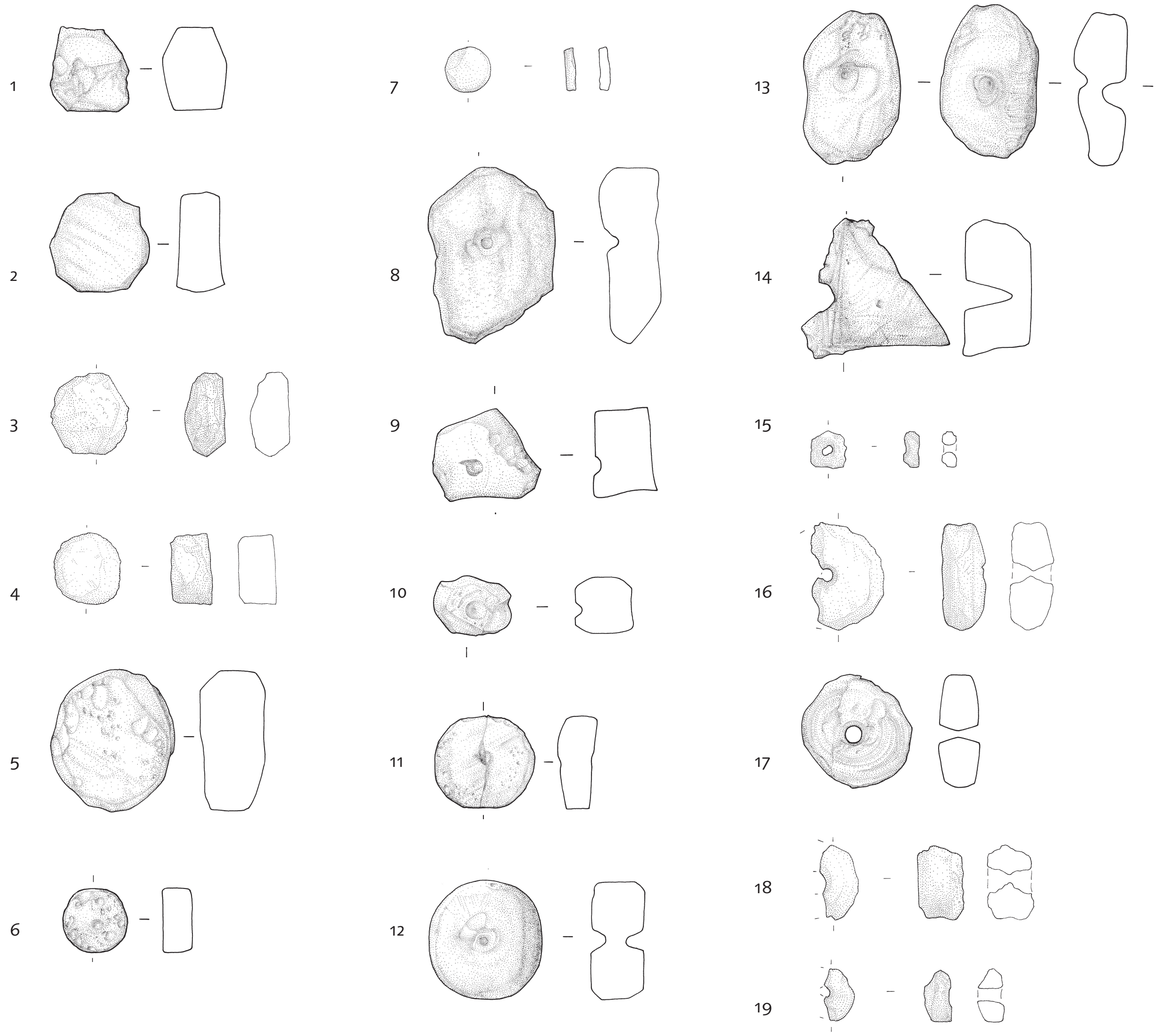


Figure 6.3 Blanks for amber beads from Kaupang. With roughly cut sides (1); almost round slices with sides cut by knife (2–3); more fully prepared, round slices with more even surfaces (4–6); a possible inlay or blank for a bead (7); blanks for beads with points marked for drilling (8–11); blanks for beads with the drilling begun from two sides but not completed (12–13); blank for a bead damaged during drilling (14); blank for a bead successfully drilled but without surface-finishing (15); blanks for beads damaged during drilling (16–19).
***1:** C52519/19644; **2:** C52516/5572; **3:** C52519/20372; **4:** C53160/38; **5:** C52519/16413; **6:** C52519/5626; **7:** C52519/20114; **8:** C52516/3816; **9:** C52516/2721; **10:** C52519/16418; **11:** C52519/14723; **12:** C52519/15332; **13:** C52519/19654; **14:** C52516/3437; **15:** C52519/22434; **16:** C52519/20343; **17:** C52519/29079; **18:** C52519/20352; **19:** C52519/20037.*
Scale 1:1. Drawing, Bjørn-Håkon Eketuft Rygh.

face which show that they were used. One bead was smoothed on the one side on some lathe, while the other side was left untreated. This bead shattered during drilling (Fig. 6.3.19).

It is probable, then, that the lathe was used for amberworking at Kaupang, but it is not clear what form it took. An illustration of a rosary beadmaker from Nürnberg dated c. 1425 gives an impression of what such a lathe might look like (Fig. 6.4).

Finished beads (N=52)

In her study of Iron-age amber finds in Sweden, Berta Stjernqvist (1998:10) evaluated which terms and taxonomy were most useful for the analysis of amber beads, which she described as a limited group of material. She preferred a less detailed system than that which had been proposed by Magdalena Tempelmann-Mączyńska (1985) for amber beads of the Roman Iron Age and early Migration Period. Stjernqvist proposed the following formal series: 1)

Figure 6.4 *Picture of a beadmaker using a lathe to make rosaries, c. 1425 (Treue 1965:131).*

round; 2) annular; 3) barrel-shaped; 4) cylindrical; 5) discoidal; 6) flat or wheel-shaped; 7) "berlock" shape; 8) biconical. Stjernqvist's classification is apt for a general grouping of the majority of the amber beads from Kaupang, but it is necessary to point out variants within some groups. In these cases it is logical to use Tempelmann-Maczyńska's type illustrations of amber beads which provide relevant figures.

The shaping of amber beads is often strongly dependent upon the form of the raw piece, and irregular shapes are common. Several scholars consider amber beads only to be finished when the surface has been smoothed to some degree or polished. As noted, however, there are some amber beads from amongst the settlement finds at Kaupang with clear evidence of use, even though no such surface treatment has been carried out. There are also examples of unpolished beads from graves. Cases of beads with surfaces showing especially careful working with the knife, but no sign of smoothing or polishing, are counted here as finished beads.

The largest group consists of *discoidal beads* (N=28), which can be divided into three variants according to their shape in cross-section. The first two variants are of varying size from very small to medium-large. The third comprises large beads that are fully preserved and weigh 3.4 and 5.6 g. These could have served as spindle-whorls. *Discoidal beads of flat-oval cross-section* (N=18; Fig. 6.5.1–2): diameter 7–22 mm, mostly <12 mm; length 2–8 mm. These are quite symmetrical in form, semi-smoothed or polished, with the exception of one which is asymmetrically perforated and two that have not been smoothed at all. Two of these are milky yellow or honey-yellow, the others mid-yellow to brownish. *Discoidal beads of oval cross-section* (N=9; Fig. 6.5.3): diameter 7–18 mm; length 2–22 mm. Mid-yellow to brownish. *Discoidal beads of nearly rectangular cross-section* (N=2; Fig. 6.5.4): diameter 21–29 mm; length 9–12 mm. Sides smoothed, partly polished or irregularly cut. Mid-yellow.

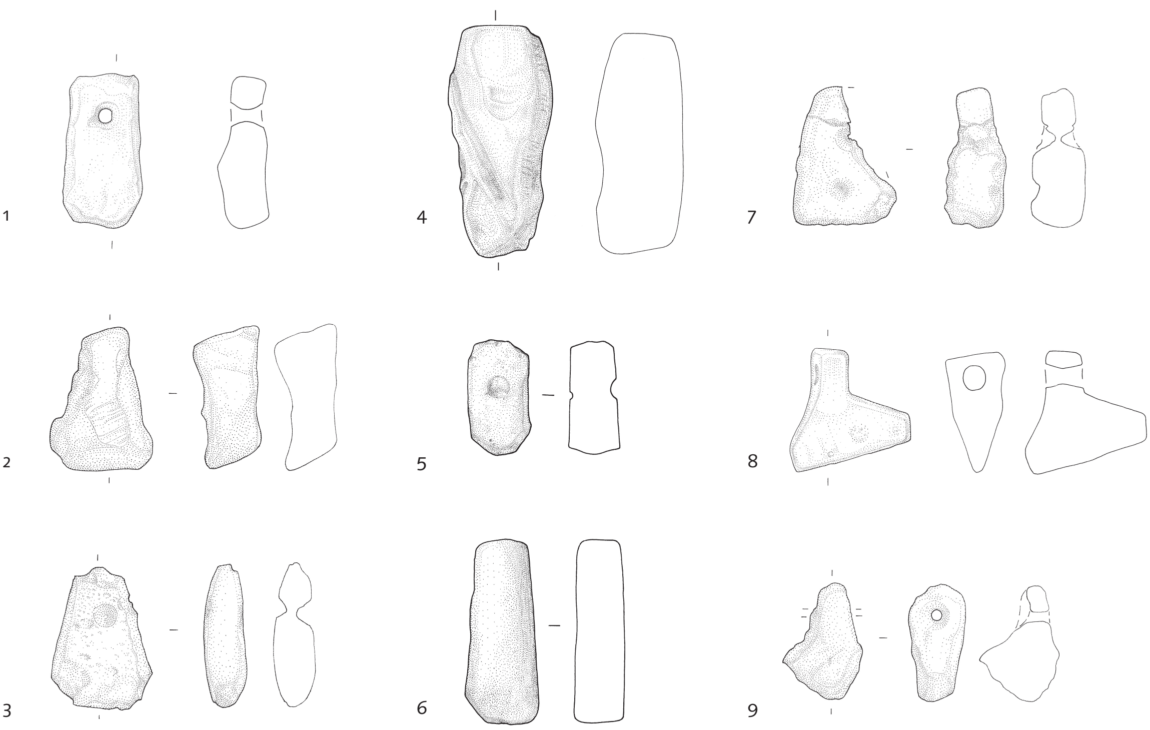
Biconical beads of lentoid cross-section (Tempelmann-Maczyńska 1985:391, 430/395, 433) (N=4; Fig. 6.5.5): diameter 8–13 mm, length 3–6 mm. One bead is turned and has an inscribed groove around the middle. Blended milky yellow to honey-yellow (1); mid-yellow (3). *Biconical beads of discus-shaped cross-section* (N=6; Fig. 6.5.6–9): diameter 8–19 mm; length 3–7 mm. Two of these were certainly turned and one further example probably so. Two are handmade and one of these has not been smoothed. Red-brown (1); brownish (4); brown-black (1). Beads of "discus-shaped" cross-section are similar to those of lentoid cross-section. The former, however, are blunted or cut plane around the circumference, where the lentoid form is a pointed oval in cross-section.

Barrel-shaped beads (N=4). One of these has a precisely shaped band around it (Fig. 6.5.10), and a surface that has not been smoothed: diameter 22 mm, length 16 mm, mid-yellow. There is a well-pre-

Figure 6.5 *Amber beads from Kaupang. Discoidal of flat-oval cross-section (1–2); discoidal of oval cross-section (3); discoidal of nearly rectangular cross-section (4); biconical of lentoid cross-section (5); biconical of discus-shaped cross-section (6–9); barrel-shaped (10–11); cylindrical of square cross-section and rounded sides (12–13); cylindrical of rounded cross-section (14); cylindrical of octagonal cross-section (15); annular (16); irregular (17).*
***1:** C52519/20353; **2:** C52519/20090; **3:** C52519/20091; **4:** C52519/16456; **5:** C52519/15957; **6:** C52519/14306; **7:** C52516/2075; **8:** C52519/24641; **9:** C52516/4081; **10:** C52519/24632; **11:** C52519/15952; **12:** C52519/14082; **13:** C52519/20365; **14:** C52519/20110; **15:** C52519/13753; **16:** C52516/4029; **17:** C52519/527; **18:** C52519/14129. Scale 1:1. Drawing, Bjørn-Håkon Eketuft Rygh.*

served parallel from a grave (Ka. 252, h). Two fragments of beads have very similar faceted surfaces, one of them polished to a high sheen (Fig. 6.5.11): diameter 16–20 mm; mid-yellow to reddish.

Cylindrical beads (N=7) occur in five variants: *Beads of square cross-section and with rounded edges* (Tempelmann-Mączyńska 1985:411) (N=2; Fig. 6.5.12–13): diameter 4–7 mm, length 7–8 mm. *Beads of faceted cross-section with sharply angled edges* (N=1): diameter 4–7 mm; length 7–8 mm. *Beads of rounded cross-section* (N=3;Fig. 6.5.14). One of these is an otherwise well-preserved bead with an area "pinched in" towards the edge at the ends: diameter 10 mm; length 14 mm; brownish. *Beads of octagonal, faceted cross-section* (N=1; Fig. 6.5.15): diameter 12 mm, length 17 mm; blended honey-yellow and dark mid-yellow. Parallels to this type are known amongst cornelian and rock crystal beads. *Annular bead* (N=1; Fig. 6.5.16): diameter c. 16 mm; length 7 mm; mid-yellow.



Beads of individualistic form (N=2). One of these is irregular in shape, rather like a triangular plate (Fig. 6.5.17), with traces of polishing or wear: maximum dimension 8 mm; length 4 mm; reddish-brown. The other is an irregularly shaped disc: diameter 4.6 mm; length 2.1 mm; mid-yellow.

Pendants and amulets
(N=14: 11 unfinished, 3 finished)

Club-shaped pendant: length 21 mm, width 10 mm, thickness 4–6 mm, weight 0.9 g. Blended honey- to mid-yellow (Fig. 6.6.1). The surface is irregular and only partly smoothed. The narrow end is perforated (hourglass-shaped).

Preforms of oblong pendants (N=8). Three worked objects may be preforms for pendants. One is oblong with partly worked edges (Fig. 6.6.4): length 31 mm, width 14 mm, thickness 13 mm, weight 4 g; colour blended honey- to mid-yellow. Another is an oblong blank with a rounded upper surface and flat underside (Fig. 6.6.3): length 25 mm, width 10 mm, thickness 7 mm, weight 1.1 g; colour brownish. The third is a less clearly shaped, club-like object (Fig. 6.6.2). Three preforms for pendants with only partly completed worked surfaces bear traces of drilling started from both sides (Fig. 6.6.5–7). One of these shattered at the perforation (Fig. 6.6.7). Colour yellow-brown.

Oblong pendants, which are also referred to as "club-shaped", "whetstone-shaped" or "shaped as a truncated pyramid", and preforms for the same, constitute a distinct group amongst the amber finds from Hedeby (Ulbricht 1990:82, Abb. 7B, 83–4, 119 and Taf. 11). Matching pendants and four stages of semi-manufactured examples from production have been recorded in York (Panter 2000b:2505–8, fig. 1221). Similar pendants are known from Birka, for instance from the woman's grave Bj.943 (Arwidsson 1989a:54, Abb.8.1b). This form also appears amongst the amber finds from Groß Strömkendorf and from comparable Viking-period trading places along the southern shore of the Baltic (Gerds 2001b:Tab. IV).

An *axe-shaped pendant* is finely made out of pale honey-yellow amber (Fig. 6.6.8). The form is that of a bearded axe with a strongly outcurved edge. It measures 16 mm at the end, 15 mm in length, and weighs 0.6 g. There is a drilled hole 3 mm in diameter where the shaft hole would be. The technical production and surface treatment in the form of smoothing and polishing are immaculate.

Preforms for axe-shaped pendants (N=3). One roughly prepared model (Fig. 6.6.9), length 14 mm, width 9 mm, thickness 6 mm, weight 0.4 g, is irregularly perforated where the shaft hole would be. A more advanced model but lacking a suspension hole is 17 mm long, 12 mm wide, 8 mm thick and weighs 0.8 g. One possible preform shows started perforation, roughly prepared with a knife. All three were made of dark brownish and red-brown amber.

There are two formally close parallels of pale yellow amber from Hedeby. There are also five axe-

Fig. 6.6 *Club- or whetstone-shaped amber pendant from Kaupang (1) and possible preforms of the same (2–4). Preforms with traces of drilling started from sides (5–7). Axe-shaped amber pendant (8) and a possible preform for the same (9).*
1: *C52519/14835,* ***2:*** *C52519/22435,* ***3:*** *C52519/14775,* ***4:*** *C52519/16459,* ***5:*** *C52519/17449,* ***6:*** *C52519/20359,* ***7:*** *C52519/20095,* ***8:*** *C53160/8,* ***9:*** *C52519/20358. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 6.7 *Amber amulet from Kaupang in the form of a foot. Photo, Eirik Irgens Johnsen, Ellen C. Holte, KHM.*

shaped preforms there, of which only one shows the strongly outcurved edge of the finished specimens (Ulbricht 1990:78, 85 and 120, Taf. 8.1–5 and 13.8–9). Three axe-shaped amber pendants are known from Birka, one from the Black Earth and two from graves Bj.943 and Bj.954 (Paulsen 1956:201, Abb.100f and k, and 203 with further refs.). From Ribe there is one axe-shaped pendant of amber which includes a shaft (Jensen 1991:51). Although the axe is a relatively common design for miniature models of various materials in the Viking Period, the group is so heterogeneous that there is no agreement over the definition and interpretation of this group (Zeiten 1997:15–18). Heinrich Beck (1973:567–8) notes ethnological and archaeological evidence that the axe served as an effective token to ward off sickness and suffering and to ensure health and well-being.

An amulet in the shape of a foot, in red-brown amber, 29 mm high and the sole 22.5 mm long, weighing 2 g, is the most demanding amber artefact found at Kaupang (Fig. 6.7). The foot was cut, semi-smoothed and shaped with sensitivity both for the overall appearance and for anatomical details. This is a narrow foot with a relatively long sole which may have been clothed in a boot to judge by the straight terminal of the sides underneath, especially in the heel region. There is no sign of any upper from the boot. At the same time, clear anatomical details are emphasized, such as the shape of the big toe and the various parts of the sole seen from below. The calf shows signs of working in the form of narrow strips running down it. The uppermost section retains the original patina of the raw material and may have been located in some socket, perhaps of metal. That could have been perforated for suspension. The miniature foot was found in Plot 1A within the possible amber workshop.

A counterpart in translucent yellow-red amber is known from Hedeby (Ulbricht 1990:86 and 120, Taf. 13.9). This was also worked in lines along its length, and some of the original patina of the raw material survives and may have been the underlay of a wide socket. There is also a semi-manufactured model boot with a suspension hole from Hedeby (Ulbricht 1990:79 and 116, Taf. 8.12). The material in this case varies from translucent amber at the foot end to opaque at the calf end. This piece was damaged when the hole was drilled but could have been used nevertheless. From Paviken there is also known a roughly cut L-shaped amber object which Pär Lundström argues (1981:93 and 95, Pl. 9.2) probably represents a foot. From Wolin there is a triskele-like figure of amber shaped like a round plate with three symmetrically protruding boots around the edge (Wojtasik 1991:88, Tab. 4.V.2). This is highly reminiscent of the symbol for Sicily: a Medusa head with three projecting legs that represent the three mountain ranges west, north-east and south-east on the island (Wilson 1990:III–IV). Two feet of bone or antler from Birka are also close parallels (Danielsson 1973b:50–2, fig. 30; Stolpe 1876, fig. 15; Zeiten 1997:11). The model foot that was found during the excava-

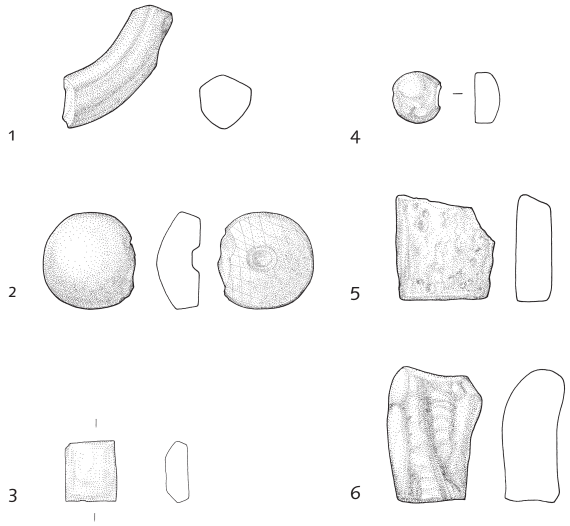


Figure 6.8 *Amber ring from Kaupang (1), gaming-piece (2), rectangular inlay (3), possible inlay (4), plate-like object of unknown function (5), unfinished item of unknown function (6).*
1: *C52519/15086;* ***2:*** *C52519/18390;* ***3:*** *C52519/15740;* ***4:*** *C52519/19660;* ***5:*** *C52519/24639;* ***6:*** *C52519/24649. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

tions in the harbour area at Birka in 1969 has no hole for suspension but shows signs of working in strips up along the calf. In connexion with the feet from Birka, Kristina Danielsson notes the practice of votive deposition of terracotta body-parts that was common in the Mediterranean area in prehistory.

Brit Solli (2002:34–5, fig. 5) has linked the foot amulet from Kaupang to Norse myths concerning the beginning and end of the world. Referring to Snorri Sturluson she sees it as a symbol of Vidar's victory over Fenrir and thus as a symbol of mastery of Ragnarök.

It is believed that votive gifts which portray some part of the body that had been afflicted by disease but healed were presented to a deity after the cure was effected. Siri Sande (1998:11) has reproduced a marble relief from the 1st century BC in the National Museum of Athens showing a man who is holding a model of a leg with evidence of a varicose vein. There are examples of how ancient representations of sickness and health associated with healing deities have survived both Ancient History and Middle Ages through frequent copying (Sande 1998:10–11). Separated body parts were most common as votive gifts in the Roman world in the time of the Republic, especially the 3rd and 2nd centuries BC. This practice was particularly widespread amongst the Etruscans (Söderlind 2002). In Greek areas it came into regular use only in the Late Antique and Byzantine Periods. Model feet are also known from Egyptian graves before the 26th dynasty (Taylor 2001:203, fig. 145), as votive gifts from Santa Gilla on Sardinia of the 3rd–2nd century BC (Botto 2000), and from the temple of Diana at Nemi (Moltesen 1997:cat. no. 69). An amulet of amber in the form of a foot from a well-furnished woman's grave at Reinheim, Saarland, southern Germany, which is dated to c. AD 400, has been considered to have some apotropaeic magical significance (Miron and Miron 1997:429-30).

Signe Horn Fuglesang (1999) links the Viking-period model foot from Hedeby closely to anatomical *ex voto* tokens of Classical and Celtic origin on the Continent. She claims that the ban upon carved model feet and idols issued by the Synod of Auxerre in the 6th century may mean that such objects had a magico-religious function in the Gallic lands at that time (1999:307). The long and widespread tradition of representing body-parts as votive gifts for healing purposes, and evidence of this tradition in the geographical and chronological vicinity of Kaupang, renders this interpretation of the foot amulet plausible.

Rings (N=2)

There are fragments of one definite and one possible ring, both of quite exactly shaped, faceted cross-section. The larger fragment (Fig. 6.8.1) is from a ring that should have had an outer diameter of 44 mm and an inner diameter of 28 mm. This can scarcely have been a finger ring. It is not clear if this ring was turned or worked on a polishing stone. It is not possible to assess the diameter of the hypothetical ring-fragment. Both pieces are of brownish amber.

There are 12 fragments of amber rings from Hedeby (Ulbricht 1990:84–5). Only a few of these are small enough to have been finger rings. In the mass of finds from York, however, there are fragments of two finger rings, while the semi-manufactured items here represent several stages in the making of finger rings (Panter 2000b:2504–6, fig. 1220).

Gaming-piece (N=1)

There is only one finished gaming-piece and apparently no semi-manufactured specimens (Fig. 6.8.2). This piece is a flat cylinder with a pronounced shoulder on to a flattened, hemispherical top. An elegantly incised chequer pattern covers the whole of the flat underside, while in the centre there is a drilled round hole. The piece weighs 0.7 g, is 13 mm in diameter and 6 mm high. It is brown-black in colour.

There are parallels in form in, for instance, a set of 12 gaming-pieces from a Viking-period grave at Østby, Tjølling, Vestfold (C10457; Petersen 1914:88–9, fig. 18). A set of twenty more hemispherically shaped amber gaming-pieces was found in the 8th-century grave in Storhaug, Avaldsnes, Rogaland (Shetelig 1912b:224–5, fig. 521b; Opedal 1998:53–5). There are also counterparts from Hedeby (Ulbricht 1990:83, Taf. 10.12–21). A parallel to the incised chequer pattern appears on the upper side of a hemispherical possible gaming-piece of jet from Brimsøy, Rennesøy, Rogaland (St7015). This is undated, but as it is from a barrow where a spindle-whorl, a spearhead and an oval brooch (R648) were also found, a Viking Period dating is plausible.

The drilled hole in the centre of the base of the Kaupang piece is common on Late Iron-age gaming-pieces. It is found on four of the 37 gaming-pieces from Hedeby (Ulbricht 1990). Similar gaming-pieces of antler from Hedeby, which in a number of cases had been made on a lathe, often have such a drilled hole too. Referring to Anna Roes (1963), Ingrid Ulbricht (1978:55 and 78; 1990:83) discussed whether these holes may have had a practical function in gripping the spike on a lathe. She rejected this because amber gaming-pieces lack turning marks, and instead supported the view that the holes are some marking related to the game. Jan Petersen (1914:90) thought that these holes could have served to keep the pieces on spikes on the gaming-board, a suggestion that was supported by Ingo Gabriel (1985:209–11).

Board-games are associated with high-status graves of both women and men in the Late Roman Iron Age and Migration Period, but only 3–5% of Viking-period graves with gaming-pieces are women's. Bergljot Solberg (2007) has emphasized the significance of the fact that board-games were linked to religious practices involving the taking of omens and divination amonst the Germanic peoples. For this activity, a shift from the private to the public sphere in the Viking Period may have led to a reduction in the association of women with board-games.

Inlay (N=1)

There is a rectangular inlay with a rounded upper side and a smooth-polished, flat underside (Fig. 6.8.3), 9.4 mm long, 6.7 mm wide, 3.2 mm thick and 0.2 g in weight; mid- to brownish yellow. One parallel, a round amber inlay fastened in a copper-alloy capsule, is known from Charlotte Blindheim's work in the settlement area (BO 59h). This piece was once thought to be cornelian (Heyerdahl-Larsen 1979b:152, fig. 2). Two round amber discs, referred to above in connexion with bead-blanks, are very similar to that item (Figs. 6.3.7, 6.8.4).

Objects of unknown function (N=31)

There is a small number of pieces of amber which cannot be classified according to the known categories of find. They comprise small, usually fragmented, objects with traces of shaping and surface treatment. It may be difficult to determine whether these were preforms, semi-manufactured items or finished objects. They differ from the type of production waste referred to here as splinters as they have details of form that are untypical of the usual artefact-types.

Plate-like objects (N=18). Some of these have almost straight, worked sides and edges (Fig. 6.8.5), while others have a less even surface and curved shape without losing their plate-like character (Fig. 6.8.6). These are small items, 6–24 mm in length. Some of them have smoothed and polished surfaces.

Cubic objects (N=3): maximum dimension 9–12 mm. These may have been blanks for small beads.

Objects of individualistic form (N=2)). A few forms stand out: a rod-like object of rectangular cross-section, maximum dimension 10 mm; a flat, half-moon-shaped object, maximum dimension 15 mm. The remainder are fragments of unidentifiable objects, with a maximum dimension of 18 mm.

Distribution of amber in the settlement area: dating and possible production sites

A total of 261 grammes of amber from datable and undatable contexts from the MRE is distributed as follows: 9% (24 g) from Site Period I; 36% (95 g) from Site Period II; 25% (65 g) from Site Period III and the medieval plough-layer; while 29% (77 g) cannot be assigned to any given period. The distribution map of finished amber beads (7) compared with that of unfinished amber beads (6) from SP I shows a concentration on Plots 3A and 3B (Fig. 6.9). The presence on Plot 2A may be due to contamination from later layers (Pilø, this vol. Ch. 9:287). The map indicates that the production and use of amber objects were common undertakings at Kaupang from the earliest phase of activity. The same holds for SP III. The quantity of finds from SP II is greater, as expected, and distinct concentrations of whole and unfinished amber beads appear on Plots 1A and 2A and to some extent in midden layers further east (Fig. 6.9). It is reasonable to conclude that amberworking was practised to a greater extent on these plots than the rest in SP II. The distribution of other kinds of amber objects produces the same picture.

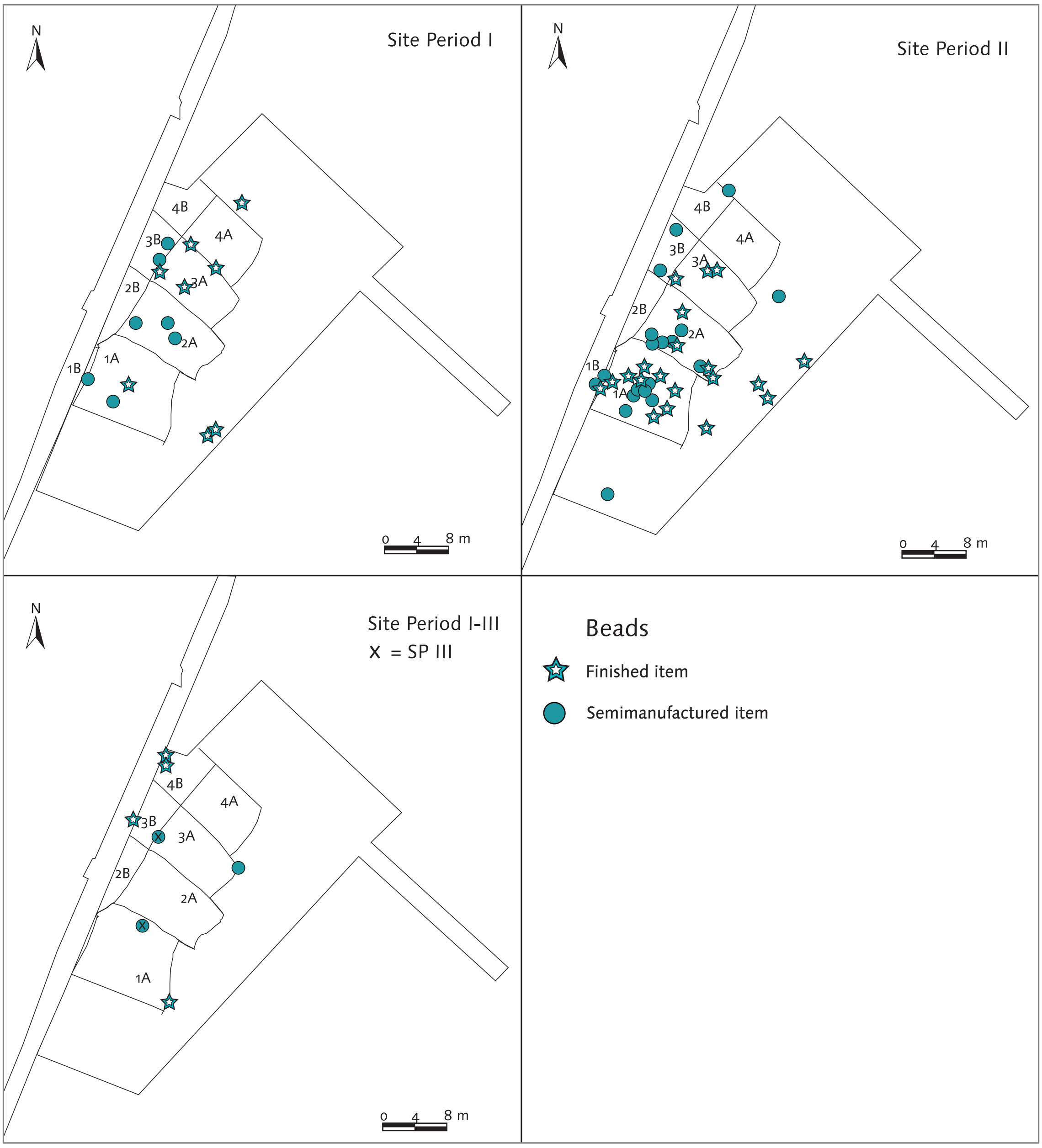
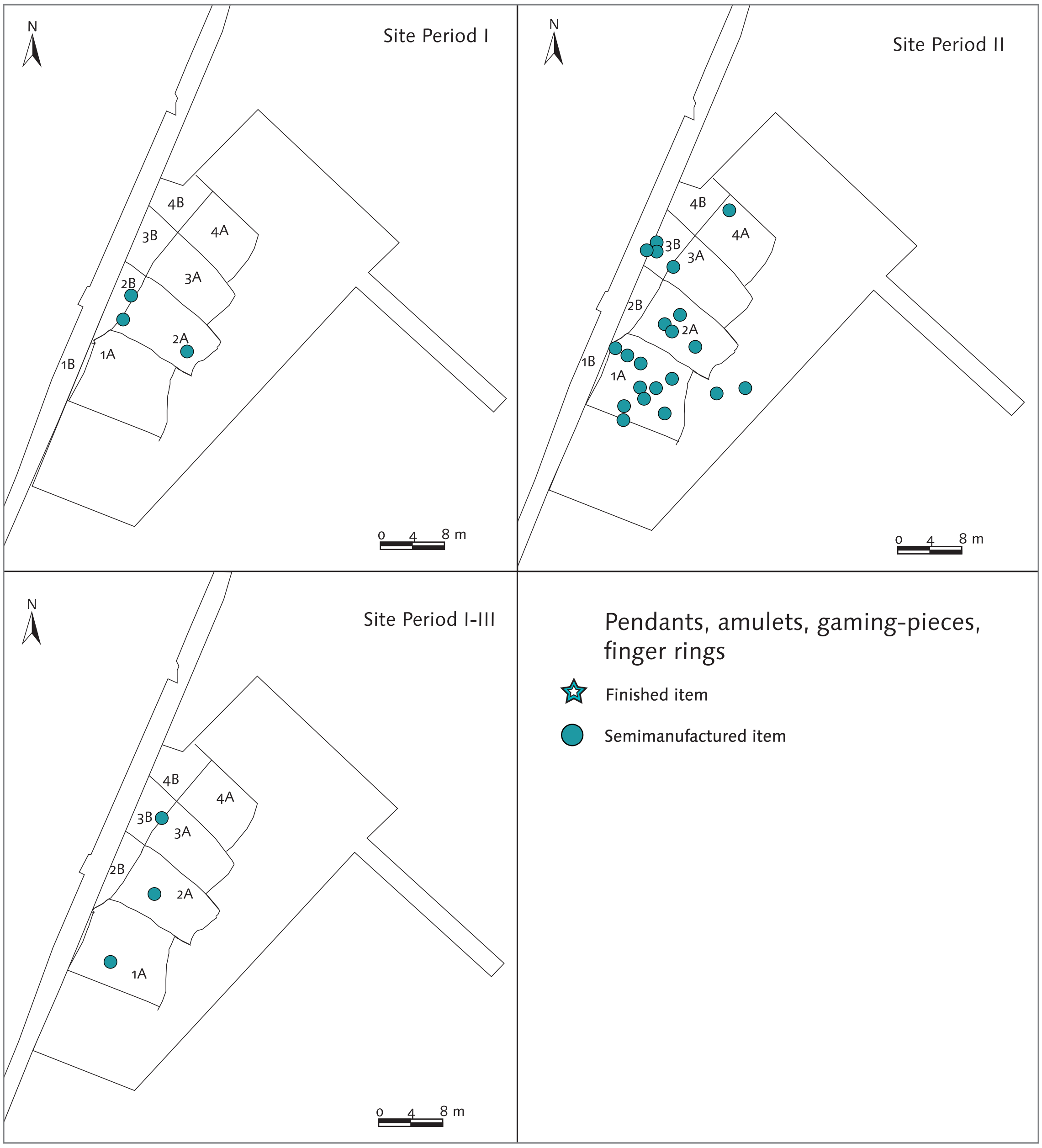


Figure 6.9 *Pp. 118–19: The distribution of amber by Site Period and object-type. Map, Elise Naumann.*

6.1.4 Comparative perspective

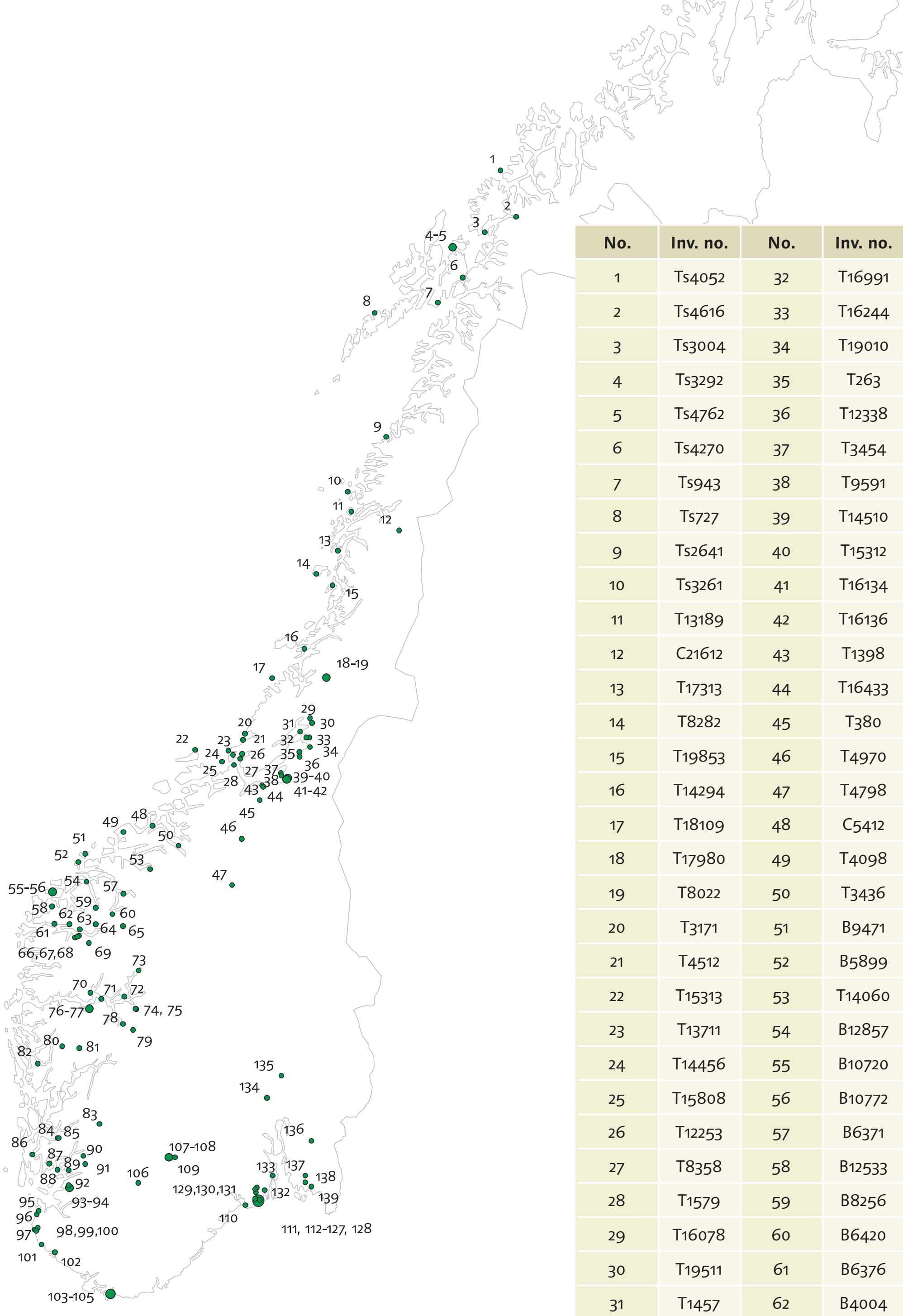
There are no substantial studies of Viking-period amber objects from Norway. Jan Petersen (1928:166) found that, apart from glass beads, beads of amber were most common in this period and that a quarter of all the amber beads in Norway had been found in Rogaland – where other types of find also testify to extensive contacts with areas of Denmark. Small amuletic amber figures were referred to by Håkon Shetelig (1946) in connexion with equivalent finds of jet. In Johan Callmer's study of Scandinavian beads of c. AD 800–1000 (Callmer 1977), amber beads are not discussed. As a result, the attempt is made here to find comparative material amongst the settlements within Kaupang's sphere of contact from which the amber finds are published. This is based



upon a selection of the Viking-period trading sites around the Baltic and the North Sea (Herrmann 1995:60, Abb. 1).

Greta Arwidsson (1989a, 1989b) produced a comprehensive assessment of the amber from **Birka**, both from Hjalmar Stolpe's excavations of graves and from parts of the Black Earth within the settlement area examined in the harbour area in 1970–71, referring to Kristina Danielsson's publication (1973a). She notes a clear difference in quality between a clear, translucent, red amber (quality A) and a speckled opaque amber (quality B). Amongst the outstanding objects of quality A she noted two gaming-pieces from grave Bj.524 (which contained altogether 15 amber gaming-pieces), a model of a cat, a pendant with linear decoration, and another in the shape of an axe. There is, however, no regular relationship between the quality of the amber and the form of objects.

Amber beads were found in 45 graves, four of which were male. There were usually one or two beads in each of these graves, combined with beads of some other material. Exceptions were several amber beads, pendants or unworked pieces of amber deposited in bags, two of these in male graves. During the excavations in the harbour area only five amber beads were found: one globular, two discoidal, one discus-shaped and one biconical. There were also 28 pieces of raw amber (Danielsson 1973a). Altogether, the amber beads are characterized as small and often coarsely worked. Larger beads are regarded as possible spindle-whorls. As raw amber is



No.	Inv. no.	No.	Inv. no.	No.	Inv. no.	No.	Inv. no.
1	Ts4052	32	T16991	63	B11096	95	S2341
2	Ts4616	33	T16244	64	B7524	96	S2326
3	Ts3004	34	T19010	65	B5030	97	S4257
4	Ts3292	35	T263	66	B6538	98	S3426
5	Ts4762	36	T12338	67	B7158	99	B2871
6	Ts4270	37	T3454	68	B5150	100	S6746
7	Ts943	38	T9591	69	B9501	101	S2349
8	Ts727	39	T14510	70	B104	102	S8038
9	Ts2641	40	T15312	71	B7640	103	C36427
10	Ts3261	41	T16134	72	B7788	104	C36429
11	T13189	42	T16136	73	B4094	105	C36430
12	C21612	43	T1398	74	B11389	106	C34684
13	T17313	44	T16433	75	B6275	107	C33157
14	T8282	45	T380	76	B7761	108	C35241
15	T19853	46	T4970	77	B9060	109	C20584
16	T14294	47	T4798	78	B8669	110	C21363
17	T18109	48	C5412	79	B7731	111	C11181
18	T17980	49	T4098	80	B13953	112–28	Kaupang
19	T8022	50	T3436	81	B6228	128	C11772
20	T3171	51	B9471	82	B5924	129	C19091
21	T4512	52	B5899	83	B6705	130	C38334
22	T15313	53	T14060	84	B8197	131	C18007
23	T13711	54	B12857	85	B12056	132	C27433
24	T14456	55	B10720	87	S3243	133	C22458
25	T15808	56	B10772	88	S6352	134	C35347
26	T12253	57	B6371	89	S4066	135	C22777
27	T8358	58	B12533	90	S4163	136	C35251
28	T1579	59	B8256	91	S2450	137	C37687
29	T16078	60	B6420	92	S2562	138	C33264
30	T19511	61	B6376	93	S3251	139	C11296
31	T1457	62	B4004	94	S5295		

Figure 6.10 *Distribution of graves from the 7th–11th centuries with amber in Norway, see Table 6.1. Map, Espen Uleberg, KHM.*

Table 6.1 *Inventory numbers for amber finds in Norway, see Figure 6.10.*

often found in the western shore area beside Birka, and a large amount of raw amber turns up in the Black Earth area, Arwidsson considers the number of amber objects in the graves to be remarkably low. Their technical quality is described as poor. There is only the one realistic model, the cat figure (Arwidsson 1989a:54, fig. 8.1a).

From the evidence at her disposal, Arwidsson could only suppose that amber was being worked in Birka; she could not prove the point. Referring to amber pendants, including a Thor's hammer in one grave and examples of amber beads and raw amber being kept in small bags in some burials, she found corroboration of the view that amber was an important material for amulets.

Excavations at the Viking-period harbour of **Paviken** on Gotland produced 268 pieces of amber with a total weight of 142.6 g (Lundström 1981:93–4). Seventy of these were worked, mostly into beads or bead-preforms. Three other objects stand out: a Thor's hammer, a possible preform for a gaming-piece, and an L-shaped item that is identified as a foot (Lundström 1981:95, Pl. 9:2). The finds represent several stages in the manufacture of amber beads at this site: the cutting of the blank with a knife; possible primary smoothing of the plane sides with a whetstone, and the marking of points for the drilling of a hole from both sides using a conical or cylindrical bit. There are examples of turned beads and of pieces with sawn or semi-smoothed surfaces. There are square, rectangular, drop-shaped, rod-shaped and irregular blanks. Amongst the beads, biconical, pointed oval and round shapes are noted.

Between 1983 and 1989 in Building I at the chieftain's farm of **Borg** in Lofoten a rounded oval amber bead was found (Näsman 2003:232–3, fig. 9G.2). A modelled amber bird figure and a piece of raw amber with traces of working were found in the waste heap from that building (Munch 2003:241–2, fig. 9H.1). Referring to the relatively high number of Viking-period models of amber and jet from Norway, and the piece of raw amber from the same context, Gerd Stamsø Munch interpreted the bird figure as a possible local product made from imported amber.

A considerable quantity of amber has been produced by archaeological excavations at various sites in **Ribe**, which lies on the amber-rich west coast of Jutland. From the excavations of 1970–6 in Sankt Nicolaj Gade, north of the Ribe River, 1,909 amber finds with a total weight of 2.011 kg were made (Botfeldt and Brinch Madsen 1991). A high proportion of these finds (1,741: 91%) were of raw amber with no signs of working, while others had signs of cutting (61) or smoothing (2). Only a small proportion were finished beads, pendants or gaming-pieces. The whole beads are grouped into natural shapes (5), flat and coarsely cut, almost square, beads (5), turned and smoothed beads (11), and unfinished or damaged beads (14). These finds bear witness to local production.

From the excavations of 1985–6 in ASR 7, Sankt Nicolaj Gade 8, 1,564 amber finds were made with a total weight of 1.169 kg (Frandsen 2006). These finds consist overwhelmingly of unworked amber (97.7%). Only 35 objects had been worked as gaming-pieces, beads or pendants. A high proportion of those items are in a semi-manufactured state. Lene B. Frandsen interprets the large quantity of unworked amber in Ribe (and to some extent in Hedeby too) as a reflection of how the proximity of rich, natural sources of amber led to the casual handling of this material.

From the area of excavation at ASR 9 Posthuset in 1990–1, there came a further 6,605 pieces of amber with a total weight of 3.354 kg (Frandsen 2006:161–8). The majority is again unworked amber and only 84 pieces are beads or gaming-pieces, or preforms for such. One special find stands out, an axe-shaped pendant, damaged when drilled (Frandsen 2006:161; Jensen 1991:51).

Ingrid Ulbricht's works on the amber from excavations and fieldwalking up to 1969 in the settlement area of **Hedeby** (1984, 1990) offer detailed information on the quantities of finds. Of a total of 4,070 amber finds, 3,608 are classified as raw material. That category comprises unworked pieces (3,173), worked pieces (226) and splinters with traces of working (229). The remainder are classified as semi-manufactured (263) and finished objects (199). Amongst the finished objects 111 beads, 37 gaming-pieces, 26 pendants, 12 rings, 8 spindle-whorls, 2 axe-shaped and 1 boot-shaped model are counted. The finished beads are mostly round discs (i.e. of a greater diameter than length). The most common form of cross-section is the pointed oval, but lentoid, biconical, discus-shaped and less regular varieties of these forms also occur (Ulbricht 1990:82, Abb. 7A). By form and size, 8 spindle-whorls could plausibly be distinguished from the group of beads.

Both semi-manufactured and finished examples of gaming-pieces reveal a range of forms based upon the hemispherical type (Ulbricht 1990:Abb. 2 and 7). Semi-manufactured pendants are consistently in the form of a truncated pyramid. The finished specimens are similar in form. There are no definite examples of semi-manufactured finger rings. There is evidence of the use of a lathe on two of the total of 12 finished rings. There are several amulet-like objects amongst both the unfinished and the finished items: there are five semi-manufactured miniature axes and two finished specimens of the same axes (Ulbricht 1990:Taf. 8.1–5 and 13.8–9). There are two half-finished Thor's hammers (Ulbricht 1990:Taf. 8.7 and 13); and an unfinished boot-like pendant (Ulbricht 1990:Taf. 8.12) can with some hesitation be compared with a very well-formed figure of a boot or a foot (Ulbricht 1990: Taf. 13.11). The tools used include the knife, various smoothing and polishing implements, a fine drill and the lathe. Only in one case can it be shown that amber was sawn. Assessing the signs of tool-use, Ulbricht found no evidence to suggest that specialized amberworking was practised here. The raw material was assumed to have been collected in the local area.

The excavations in the dense settlement of **Ralswiek** on Rügen, which is associated both with Slavonic and Viking cultures, produced a small assemblage of amber. Ten beads, 2 discoidal spindle-whorls, 1 finger ring, 4 gaming-pieces – 2 hemispherical and 2 pyramidal – and a few pieces of raw amber are picked out and illustrated in the publication (Herrmann 2005). Areas in which amber beads, rings, spindle-whorls and gaming-pieces were manufactured have been identified. This activity was carried out in the same buildings as horn- and boneworking and blacksmithing. The quantity of raw amber, semi-manufactures and waste is, however, sufficiently small that Joachim Herrmann (2005:217–19) considers it unlikely that amberworking at Ralswiek was for any other reason than to supply the local population.

From graves and from the settlement area at **Groß Strömkendorf** on the Wismar Bay, excavations in the years 1989–92 and 1995–9 have produced 3,003 amber finds with a total weight of about 2 kg (Gerds 2001a, 2001b). Of the 2,806 amber finds from the settlement area, 2,543 are of raw amber, 133 of raw amber with traces of working, 113 semi-manufactured items and 17 finished objects. The semi-manufactures include beads, pendants and gaming-pieces, while the finished objects are beads. The beads are round discs of various cross-sections: oval, annular, biconical, discus-shaped, cylindrical and rounded, while some have traces of the use of a lathe (Gerds 2001b:116–17, figs. 20–34). The pendants are of simple geometrical shapes (Gerds 2001b:fig. 1.40–6). The gaming-pieces are relatively uncertain half-made items of an approximately hemispherical form. The number of semi-manufactured beads reveal the probable stages of manufacture from blank to finished item (Gerds 2001b:fig. 2).

In Marcus Gerds's view, the distribution of the amber in the settlement area does not allow one to identify any workshop sites. The production of amber objects is also not considered to be a specialized craft as it required simple tools (a knife, drill and smoothing implements) apart from the lathe, which was widely available. Despite the paucity of finds of finished amber artefacts at Groß Strömkendorf, he nonetheless regards it as reasonable to believe that finished amber products were traded beyond the settlement.

The most significant site for amberworking in the Viking Period and early Christian Middle Ages in this area was undoubtedly **Wolin** at the mouth of the Oder (Wojtasik 1957, 1991, 1992). This activity is documented from the end of the 9th century to the 11th, and large quantities of amber artefacts, semi-manufactured items and raw amber amount to around 100 kg in weight (Filipowak 1985:128 n.12). The following quantities, which have been taken from Marcus Gerds (2001a, 2001b), derive from Jerzy Wojtasik's works (1957, 1991, 1992). 3,600 unworked pieces of amber have been found and more than 20,000 with signs of working, including production waste and small splinters. It was primarily beads and pendants that were produced, represented by 776 semi-manufactured beads and 595 finished beads, and 80 semi-manufactured pendants and 66 finished pendants. The most common bead-types at Wolin are polyhedrical, square with sloping sides, and cylindrical. Less common are spherical beads, or round beads of oval, lentoid, biconical or other cross-section. The number of turned beads is small. There are 45 pendants of widely varying form, such as truncated pyramids and flat geometrical shapes. Amuletic pendants are a distinct group. These include cruciform and half-moon-shaped pendants plus Thor's hammers. Several pendants have faceted surfaces like the polyhedrical beads. There are also some amuletic model figures in amber: a fish head (Wojtasik 1957:156, Tab. II.9), a disc with three boots (Wojtasik 1991:88, Tab. 4.V,2), an animal figure (Wojtasik 1992:193, Tab. 6.I,5), and a horse figure (Wojtasik 1992:Tab. 6.V,15).

From the excavations organized by the Rijksdienst voor het Oudheidkundig Bodemonderzoek (ROB) in **Dorestad** since 1967, around 5,000 pieces of unworked amber have so far been found with a total weight of about 18 kg (Kars and Wevers 1983b). There are reports of the recovery of dozens of kilos of raw amber from earlier work on the site. However only a few finished objects are known from the site: 5 spindle-whorls, 3 whetstone-shaped pendants, 3 bridges for lyres, 2 possible gaming-pieces, 4 beads and 1 bead-preform, together with a number of fragments of unknown type (Kars and Wevers 1983b:61–4). To explain the small number of finished amber objects, the methods of excavation are cited, which would not have recovered small fragments of amber, the fact that the site has been severely affected by treasure-hunting, and that the conditions are poor for the preservation of amber – however also that finished goods may have been traded out of Dorestad.

The amber from Anglo-Scandinavian **York** amounts to 592 finds, of which 73 are classified as raw amber, 337 as production waste, 84 as beads, 31 as finger rings, 55 as pendants and 12 as unidentified objects. The figures include both finished and unfinished items (Mainman and Rogers 2000:2632–5, 2654, 2655 and 2657–60). These finds are mostly from the excavations at 16–22 Coppergate, but there are also significant finds from Clifford Street in 1884. Knives were important tools used in preparation, but the working signs suggest that the chisel and saw could also have been used when first cutting the amber up. There is possible evidence of filing (Panter 2000b). Drilling was normally done from both sides. There is evidence of the lathe from linear marks running around both beads and finger rings.

Because of the relative wealth of preforms, semi-manufactures and finished items from Clifford Street, Ian Panter proposed a detailed reconstruction of the production process involving four to six stages from rough blanks to finished beads, finger rings and pendants (2000b:2504–7). The distribution of all finds of amber associated with production supported postulated workshop zones within the excavated areas in Coppergate (Panter 2000b:2509–17).

The objects of amber from **Kaupang** consist mostly of beads, and there are a few pendants, amulets in the form of an axe, a foot and a female figure, rings, inlays, and a gaming-piece. Beads, pendants and possible axe-amulets are present in a semi-manufactured state. The latter show that both a rotating drill and the lathe were in use, while knives were the most important tool. There is no evidence of sawing. Smoothing and polishing are important tasks in the shaping of amber objects but we have no clear evidence of what sorts of tool or abrasives may have been used.

Only a small fraction of the amber finds from Kaupang are of pale yellow amber. The majority are of mid-yellow, reddish or brownish amber. This may be a function of the raw material that was available, or the supply of finished items from outside the town. Some beads, and the finished axe-pendant (Fig. 6.6.8), are in pale yellow amber. Some well-formed beads are of a blended pale and darker amber. This is the case, for instance, with one cylindrical bead of faceted, octagonal cross-section (Fig. 6.5.15), a shape that is characteristic of beads of cornelian or rock crystal.

Amber beads of the forms most commonly found at Kaupang also occur at the majority of the larger settlements referred to above. Amongst the beads from Wolin, however, there are a number of examples of a special type of faceted bead with counterparts in beads of cornelian and rock crystal. Two such beads have been found at Hedeby (Ulbricht 1990:117, Taf. 9.10–11) and one at Fyrkat (Roesdahl 1977:37, fig. 31j). The cylindrical bead from Kaupang referred to is thus clearly related to a form found amongst cornelian and rock crystal beads (Callmer 1977:S011 and T009). It is, however, of a different form from those at Wolin, Hedeby and Fyrkat noted here.

Various amber pendants and gaming-pieces were also used and made at several of the sites reviewed, especially at Ribe, Hedeby, Ralswiek, Groß Strömkendorf, Wolin and York (pendants). These categories are as yet weakly represented at Kaupang. That is also the case with spindle-whorls. A small but important category of amber finds at Kaupang, however, is the amulets in the form of model figures. This type of find has already been thoroughly discussed in Norway. Particularly, attention has been given, above, to parallels to the axe-shaped pendant from Hedeby, Birka and Ribe. Parallels, in amber, to the foot-shaped amulet from Kaupang are known from Hedeby, Paviken and Wolin, while Birka has two matching objects of bone or horn.

Both the supranational distribution of uniform amber objects and especially the quantity of amber found at Kaupang suggest particularly close contact with trading sites along the south coasts of the Baltic and the North Sea. It is reasonable to postulate that both the supply of raw material and precise knowledge of the tools used for polishing amber, experience in the craft, and ideas for the specific items to be made, may have been the product of direct connexions between Kaupang and some of the amber-producing areas referred to above.

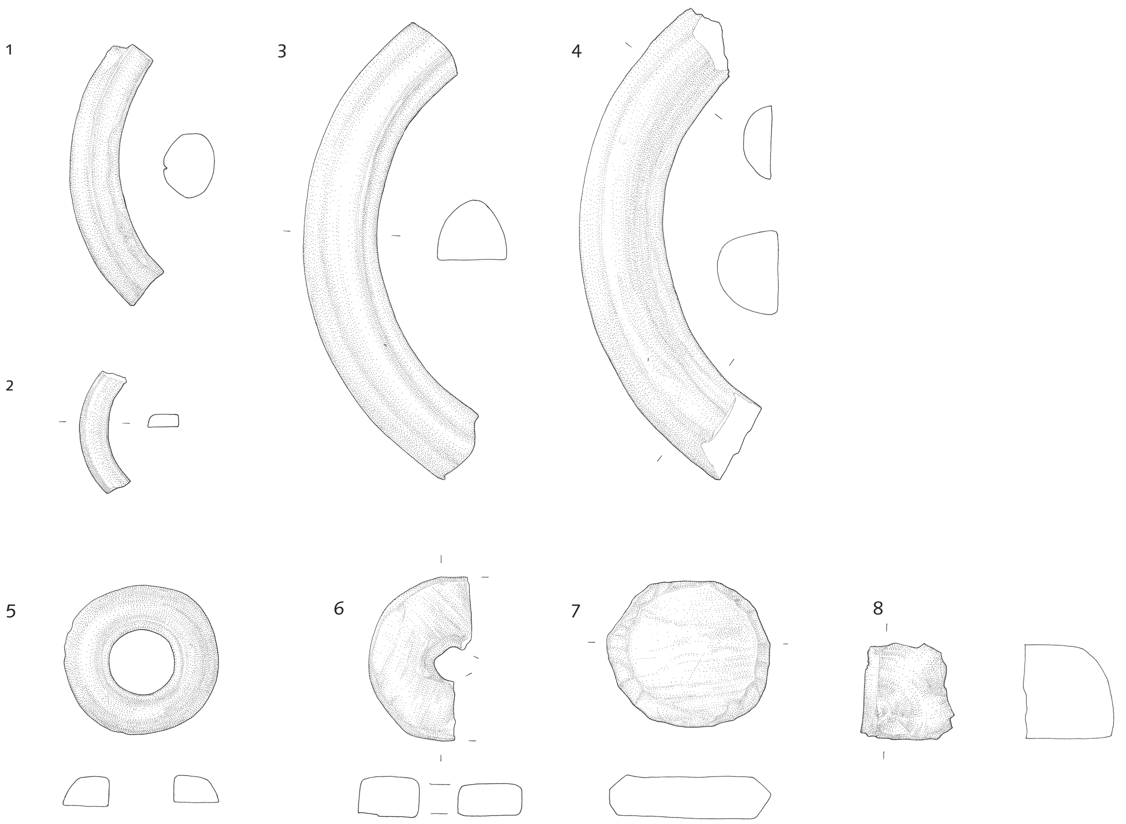
6.2 Jet and jet-like materials

Jet is a variety of browncoal, fossilized wood from a type of tree similar to the modern Araucaria which was growing in the Jurassic Period, about 180 million years ago. When the trees fell, they could sink into wet ground, or fall into a river and eventually reach the sea. Weighted down by disintegrating vegetal matter, a chemical change of the wood to jet occurred. Analyses of the oil-content have shown that what is known as "hard jet" was formed in salt water while "soft jet" was formed in fresh water. Both have the same degree of hardness (3–4 on Moh's scale), but hard jet is more solid and resilient while soft jet is more brittle and splits more readily when it is being worked or is heated. Like amber, jet is very light, and when rubbed produces static electricity. On breaking, jet forms shell- or snail-shaped plates, in which the fine tree-rings of the wood are sometimes visible to the naked eye. Jet has an intense black hue, and worked surfaces can be polished to a high glaze (Muller 1998, with further refs.).

Other jet-like materials, such as cannel coals, lignites, oil shales and bitumens (Watts et al. 1997:125) have also been used for jewellery in the same way as jet. Unlike the remainder, shale is described as "a sedimentary rock, principally composed of clay minerals. Although there are a number of varieties of shale, the principal one used in antiquity appears to be the oil-rich shale, which had a high concentration of hydrocarbons, which allowed it to be highly polished." (Panter 2000a:2470).

A number of misunderstandings have arisen from the assessment of finds of jet from earlier excavations at Kaupang, mainly because it is so difficult to distinguish between jet and other jet-like materials. In certain cases objects of stone, coal and glass have been counted as finds of jet. It is now possible to work with a larger and better defined assemblage thanks to the recovery of new finds from the settlement area. The gemmologist Brenda Jensen has carried out a critical review and Professor Unn Plahter a scientific analyses of the finds (this vol. Ch. 7). The material differences between jet and other jet-like materials within this collection of finds raise further questions, however, rather than just providing clear and simple answers concerning, for instance, where the material is from. In what follows, the term "jet" is sometimes used for simplicity's sake as a general label for this group of finds.

Altogether, there are 23 different objects in the assemblage of finds of jet and jet-like materials from



all of the campaigns of investigation at Kaupang. The collection consists of 12 armrings, 8 smaller rings and 3 raw pieces. There is an overview of these finds in Plahter's chapter, and her table includes the present author's catalogue descriptions of the jet objects (Plahter, this vol. Ch. 7:Tab. 7.2, hereafter referred to as "Cat."). Three of the smaller rings can be classified as finger rings. The form of the remainder lies somewhere between a bead and a spindle-whorl, but they might have had other functions too.

There are five finds that can shed light on the question of whether jet was worked at Kaupang: a semi-manufactured bead or ring (Fig. 6.11.7, Cat. No. 7), an unfinished, unpolished bead that broke at the hole (Fig. 6.11.6, Cat. No. 14), and three pieces of raw jet (Fig. 6.11.8, Cat. Nos. 1–3).

There is a small ring or bead with a rounded upper side and a flat underside (Cat. No. 4). The upper side is evenly polished and the underside more irregular, although that too has been polished. This form appears to be unusual, and it is remarkable if this is how the piece was originally produced. It is conceivable that this object was damaged when split and that the surface of the break was re-polished with a view to re-use. There is also a similar bead-fragment (Fig. 6.11.5, Cat. No. 18) with a polished upper side and a damaged, flaked underside.

In her review of the jet finds from the settlement area at Kaupang, Brenda Jensen identified fourteen finds with the following common features. They produce a chocolate-brown scratch-mark, have a tendency to split parallel to the layering of the material, have a uniform grey-black surface that is usually markedly ribbed, and have a hardness of below 4. About three-quarters of the armrings have split so that only about half of the original cross-section is preserved. Plahter's studies have shown that nearly all of the objects of jet from Kaupang are made of shale. The splitting referred to was along the line of the natural layering of this material (Plahter, this vol. Ch. 7).

A few rings are fully preserved in cross-section. A somewhat unevenly shaped but well-preserved finger ring (Cat. No. 12) has an almost D-shaped profile. It is straight on the inner side, convex on the outer side, and somewhat extruded on the sides. Two broken armrings (Cat. Nos. 17 and 19) both are of pointed oval cross-section. Another armring (Fig. 6.11.1, Cat. No. 5) is of oval cross-section. The latter is unusual in that it has a groove running around it that has either been incised or produced by wear on the outer surface. This groove, which only appears on some of the outer surface, looks as if it might have held a metal wire which only partly enclosed the ring. The majority of the damaged, split armrings seem to have been of oval or almost round cross-sec-

Figure 6.11 *Items of jet and jet-like materials from Kaupang. Armrings (1–3), finger ring (4), bead or spindle-whorl (5), unfinished bead (6), semi-manufactured bead or similar object (7), raw material (8).*
***1:** C52517/1360; **2:** C52516/3856; **3:** C52519/9760;*
***4:** C52519/11183; **5:** C52519/19807; **6:** C52519/9907;*
***7:** C52519/11096; **8:** C52519/18604.*
(Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.

tion (e.g. Fig. 6.11.2–3). Some have a clearly faceted inner side or outer side. Only a few, however, can be described as distinctly D-shaped, a form which, together with the rounded form, is noted as being typical of jet rings from Anglo-Scandinavian York (Mainman and Rogers 2000:2599). The D-shaped cross-section is also common on the majority of Scottish Viking-period armrings and finger rings of jet-like materials (Hunter 2008:104 and 107), and no different from jet rings of earlier periods.

The size of the armrings at Kaupang based on the inner diameter shows that the majority were 56–65 mm in diameter (7), two were smaller (46–55 mm) and two larger (66–70 mm). The Scottish Viking-period armrings have a similar range of sizes (Hunter 2008:107, tab. I).

Objects of jet are included in two grave-assemblages at Kaupang. There is a well-preserved armring clearly showing the texture of the wood from grave Ka. 218 at Lamøya (Cat. No. 21) and a bead from grave Ka. 301 or Ka. 304 (Blindheim and Heyerdahl-Larsen 1995:30, pl. 21, K/VI gr. Ih; Heyerdahl-Larsen 1999:67). The latter object is currently lost and so has not been included in this study.

6.2.1 Evidence of the working of jet at Kaupang?

As has been noted, the finds include three small pieces of raw material and a couple of items that appear to have been worked. Unn Plahter's study (this vol. Ch. 7) concludes that these pieces of raw material are the only examples of true jet found at Kaupang.

One unfinished discoidal shale bead broke at the perforation (Fig. 6.11.6, Cat. No. 14). Its edges are roughly cut while the larger surfaces are uneven, following the natural layering of the material. There is no detectable sign of smoothing or polishing. A rounded discoidal object of cannel coal or shale has cut-marks along the rounded edge, while the larger surfaces follow the natural layering of the material (Fig. 6.11.7, Cat. No. 7). As already noted, there is also a bead or ring of cannel coal or shale with a damaged, split, surface that seems to show signs of re-polishing (Cat. No. 4).

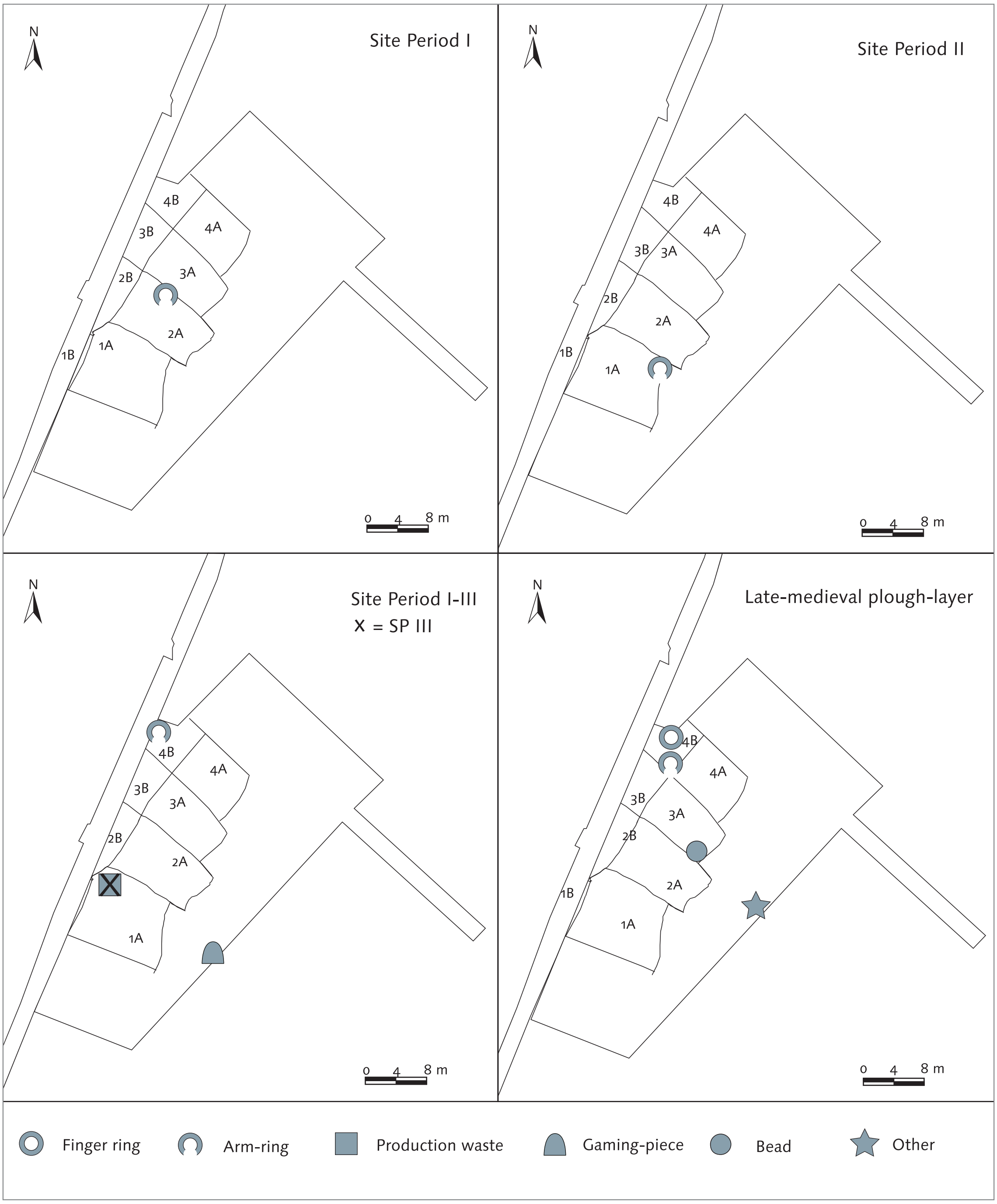
It is beyond dispute that there are a few unfinished objects amongst the finds from the settlement area as well as a few small fragments of possible raw material. This is clear evidence that jet and jet-like materials were being worked in Kaupang. If one considers the finds of these materials altogether, it appears most likely, all the same, that local jet-working was of limited scope, and that the artefacts were mostly imported ready cut, turned, smoothed or polished. The number of armrings is striking. Some rings, by size and form, are neither suited as armrings nor finger rings and their function is unknown.

The distribution of the minority of finds of jet that can be assigned to Site Periods at Kaupang reveals the use of jet objects in all phases (Fig. 6.12). Five of the finds are associated with SP I, SP II and SP I–III, four with the later medieval plough-layer and the same number with the even later ploughsoil. It is worth noting that one find of SP I–III and one of SP III are: a piece of raw material (Fig. 6.11.8, Cat. No. 3), and a semi-manufacture (Fig. 6.11.7, Cat. No. 7), respectively. These are located on Plot 1A and the midden area east of it. Another unfinished object (Fig. 6.11.6, Cat. No. 14) was found a little further north-east, close to the midden area beside Plots 2A and 3A. Without wanting to press these facts too hard, it is interesting to note the proximity of these finds to Plot 1A where there are signs of technically related craft production of objects of amber.

6.2.2 Comparative perspective

The total of 23 objects of jet found at Kaupang may not seem much. Considered in light of other finds of jet from Viking-period Norway and from comparable trading sites in Scandinavia, however, the amount at Kaupang is remarkable. Since Håkon Shetelig published his pioneering study of these finds in 1946 only a few new finds have been made, and the total amount found outside of Kaupang is now 19 objects from 17 finds (Shetelig 1946:4–6 and 9; Wamers 1985:117–18; Resi 2005:98–100). The majority of finds of jet that can be dated more closely are from the 9th century (9 women's graves, 1 man's grave) with fewer from the 10th century (4 women's graves). The finds in Norway are mostly quite large beads, a few rings of various sizes and three figures with animal designs (Resi 2005:89, fig. 2). It has long been suggested that the Norwegian Viking-period examples of small figures of jet and amber are so similar to Scandinavian works, such as the carvings in the Oseberg find, that they must have been made in Scandinavia using imported raw material (Shetelig 1946:11–12).

The jet finds from Kaupang are quite differ-



ent from the grave finds referred to in the quantity of rings and the style of the armrings. A fragment of a ring of this size, but with a different cross-section, is also known from just one grave-assemblage (Ts9669f, Sund i Nordland.; Resi 2005:fig. 2.12). There is a medium-sized ring from a grave at Høyland in Rogaland (B5628; Shetelig 1946:fig. 1). In the case of finger rings, the three specimens from Kaupang have a parallel in one find in a well-furnished woman's grave of the 9th century at Gausel in Rogaland (St42330; Shetelig 1946:5). Fragments of an unfinished ring, somewhat larger than a finger ring, were also found in a posthole in the hall at Borg in Lofoten (Ts8335w; Munch 2003:241–2). The number of armrings and finger rings from the settlement excavations at Kaupang might be seen as evidence that this type of jewellery was in rather more common use than the grave finds would suggest.

There are a few jet finds from Birka. A jet armring is known from the chamber grave 860A (Aitken and Arwidsson 1986:74–5; Arbman 1943:335). There are also fragments of two rings from the settlement excavations directed by Hjalmar Stolpe (SHM 5208:2517) and a piece of what is thought to have been an armring from the excavations in the harbour area (Danielsson 1973a:67). Armrings are also predominant amongst the finds of jet at Birka.

There is a bead from the military stronghold

Figure 6.12 *The distribution of jet by Site Period and object-type. Map, Elise Naumann.*

at Aggersborg in Jutland (Roesdahl 1981:115), and a ring from Andersminde, a Viking-period settlement near Ribe (Hansen 1982:33–4; Hunter 2008:111). From Hedeby, a jet armring is reported (Capelle 1968:109, Taf. 24.6), and from Iceland a jet armring from a woman's grave at Álaugarey, Austur-Skaftafellssýsla (Eldjárn 2000:587, fig. 127). There are references to Viking-period grave-assemblages and a number of settlement finds with armrings of the same kind from Shetland, the Faroes, the Orkneys, Scotland and the Isle of Man (Shetelig 1946:6–7; Wamers 1985:117–18; Hansen 1996:127; Hunter 2008). In agreement with the Norwegian finds, this testifies to the wide area of distribution of jet and jet-like materials in the Viking Period. In some cases evidence has been identified of the local shaping/production of objects of jet-like materials, such as rings at Ronaldsway on the Isle of Man (Shetelig 1946:7) and in Dublin (Hansen 1996:127).

The greatest attention in this case is naturally due to the excavations of the Anglo-Scandinavian settlement at York, which is not far from the known outcrops of jet at Whitby in Yorkshire (Mainman and Rogers 2000:2498–500). Finds of jet, shale and other jet-like material from 16–22 Coppergate – 4 raw pieces, 1 worked piece and 2 preforms in the form of round discs – are identified as evidence of the local working of jet in an Anglo-Scandinavian context (Mainman and Rogers 2000:2498). Some further objects of jet from the same site, such as gaming-pieces and finger rings, are less easy to determine, because they could be residual finds from another period (Roman or medieval) (Mainman and Rogers 2000:2567 and 2587–8). The same uncertainly also applies to some extent to jet or shale armrings, although the authors regard finds of round or D-shaped cross-section as probably Anglo-Scandinavian (Mainman and Rogers 2000:2599). Looked at in light of Unn Plahter's identification of the jet rings from Kaupang as being overwhelmingly of shale, it is interesting to note that according to the catalogue of seven Anglo-Scandinavian armrings from 16–22 Coppergate, 3 are identified as shale, 3 as jet-like material but not jet, and only 1 as jet (Mainman and Rogers 2000:2632). Identifications of the material of Viking-period jet-like objects from Scotland also show clearly that pure (Whitby) jet occurs rarely (Hunter 2008).

In the present state of scholarship and publication, it is difficult to get a clear view of the quantity of jet finds from many similar sites in northern Europe. A relatively small number of published finds of jet from the graves and settlement area at Birka (4) also consists of rings. Finds of beads or rings of jet are briefly described from Aggersborg and Hedeby, and from Viking-period sites in Iceland, the Orkneys, Shetland, the Faroes, Scotland, the Isle of Man and Ireland.

Finds of jet and jet-like materials in an Anglo-Scandinavian context in York have been published in an exemplary study. Furthermore, more detailed identifications of material and the grouping of semi-manufactured objects amongst the finds from York have provided an interesting basis for assessing the object-types found at Kaupang, and the mixed material of shale, possible cannel coal, and true jet. As of yet, this is where the closest parallels to the jet finds at Kaupang lie. But other sites with raw material and semi-manufactured items amongst the finds (the Isle of Man and Dublin) encourage one to anticipate new scholarly discoveries concerning sources of raw material and comparable forms of object. Fraser Hunter's article (2008) mapping the outcrops of lignite and oil shale/cannel coal in Northern Ireland and northern Britain compared with the distribution of jet-like objects of the Viking Period in nearby areas makes an interesting contribution to the discussion of the provenance of the relevant jet-like materials.

Acknowledgements

My sincere thanks to Marcus Gerds for permission to read and refer to his as yet unpublished thesis of 2001 on amber finds from Gross Strömkendorf. It was of great help. My thanks also to Vegard Vike for identifications of the material of uncertain amber finds from Kaupang and for the reference to the picture of a beadmaker (Fig. 6.4). I am greatful to Einar Østmo and Lene Melheim for information on the use of amber in Norway in the Stone and Bronze Ages, and to Marina Prusac for advice and references on ancient parallels to the model foot from Kaupang. I am indepted to gemmologist Brenda Jensen for her thorough examination of amber and jet-like finds, and to Professor Unn Plahter for her work on the scientific identification of jet-like objects from Kaupang and comparable finds in the Museum of Cultural History, Oslo.

Appendix 6.1
List of amber finds

Finished beads

Discoidal beads of flat oval cross-section
C52516/1061, /1406, /3345, C52519/13758, /14131, /15329, /15955, /17147, /18391, /19605, /19617, /20023, /20090, /20258, /20353, /20370, /22670

Discoidal beads of oval cross-section
C52167/7, C52516/3771, C52519/19627–8, /19639, /20091, /20092, /24630, /25549, C53160/29

Discoidal beads of nearly rectangular cross-section
C52516/4082, C52519/16456

Biconical beads of lentoid cross-section
C52519/13567, /15535, /15957, /24646

Biconical beads of discus-shaped cross-section
C52516/1923, /4081, C52519/14306, /14540, /24632, /24641

Barrel-shaped beads
C52519/14082, /15402, /15952, /20351

Cylindrical beads
C52516/1605, /1923, /4029, C52519/13753, /19610, /20110, /20365

Annular bead
C52516/527

Beads of individual form
C52519/14129, /22434

Bead preforms

C52516/2437, /2721, /3816, /5573, C52519/13546, /13556, C52519/13707, /13879, /14431, /14438, /14723, /14911, /15085, /15140, /15200, /15332, /15402, /15624, /15954, /15969, /16413, /16418, /16458, /17447, /19644, /19645, /19647, /19654, /19660, /20033, /20037, /20102, /20114, /20343, /20352, /20372, /22417, /22430, /22434, /28111, /28174, /29012, /29079, C53160/38

Pendants and amulets

Club-shaped pendant
C52519/14835

Preforms of oblong pendants
C52519/14775, /16457, /16459, /17449, /20095, /20359, /22435, /24628

Axe-shaped pendant
C53160/8

Axe-shaped pendant preforms
C52519/17146, /20358, /22435

Foot-shaped amulet
C52519/15942

Ring

C52519/15086

Possible ring
C52516/3726

Gaming-piece

C52519/18390

Inlay

C52519/15740

Objects of unknown function

Plate-like objects
C52519/13558, /13707, /14391, /14432, /14447, /14943, /15392, /15555, /15905, /19636, /20099, /20104, /20113, /24604, /24627, /24627, /24639

Cubic objects
C52519/13816, /17137, /23415

Objects of individual form
C52516/3925, /4082, C52519/13555, /14547, /14910, /14922, /19638, /20347, /22673, /24649

Analyses of Jet-like Objects

7

UNN PLAHTER

Previous characterisation of black lithic artefacts uncovered in Norway has been based on visual assessment, with the limitations this method may suffer from.[1] In this study, the Kaupang assemblage of jet-like materials was analysed using non-destructive scientific methods. A rough quantification of inorganic constituents was obtained with a handheld X-ray fluorescence instrument, and X-radiographs indicating differences in X-ray opacity relative to the proportion of organic and inorganic material. Together with the character of the fracture surfaces these analyses were used to classify the material as jet, intermediates, or shale. FTIR and SEM-EDX analyses of one sample of an organic rich unworked lump were obtained. Three lumps were identified as jet/lignite, while the remaining twenty objects were classified as cannel coal/oil shale (4) or oil shale (16).

Petrographic analysis using reflectance measurements have been applied successfully for the identification and provanancing of organic rich coals such as jet, cannel coals and oil shale. This method was not attempted in this study but would allow for more accurate identification and provenancing of the raw materials of the Kaupang assemblage.

Black shiny materials such as jet, lignite, cannel coal and oil shale have all been used for the manufacture of artefacts in the past and belong to a group of black lithic materials. They are the product of coalification of plant material in anaerobic environments over millions of years. True jet derives from fossilized wood formed slowly under anaerobic conditions and pressure. It has retained its wood structure, which may or may not have been compressed. Lignite also derives from wood but does not show the same degree of disintegration and compression as jet. The non-jet materials such as cannel coal and shale derive from sediments (sapropelic sediments) and have therefore a layered structure. As cannel coals are more compressed and more compact than shale their laminar structure is less obvious and has less effect on the mechanical properties of the material. These lithic materials contain variable amounts of inorganic material: jet and cannel coal have a high organic content, more than c. 80%, and cannel coal is said to "grade into shale as the mineral content increases" (Watts 1996:27). Shale is defined as a sedimentary rock formed by a uniform mass of clay-sized materials (Davis 1993:43; Watts 1996:30), containing more than 10% organic material but normally less than 70%. For the manufacture of artefacts a proportion of organic material higher than 10% is essential. The following investigation is based on the scientific analyses of jet and jet-like material in archaeology over the last 30 years (Pollard et al. 1981; Teichmüller 1992; Hunter et al. 1993; Davis 1993; Watts 1996; Watts et al. 1997; Panter 2000; Allason-Jones and Jones 2002; Hunter 2008).

Twenty-three objects (one divided in two pieces) retrieved during Blindheim's excavations of graves (1) and settlement (6) of 1950–74 and Skre's Kaupang excavations of 1998–2003 (16) were analysed. The assemblage includes 12 armrings, 3 finger rings, 5 beads and discs of various types and 3 lumps of unworked material, all listed in Table 7.2 and

1 During an earlier review of jet-like material the author did not recognize that the finger ring from Hjerkin C37230–98 was made from black bone rather than jet (Resi 2005). However, the use of black bone for making a finger ring may represent a conscious attempt to imitate the much admired true jet.

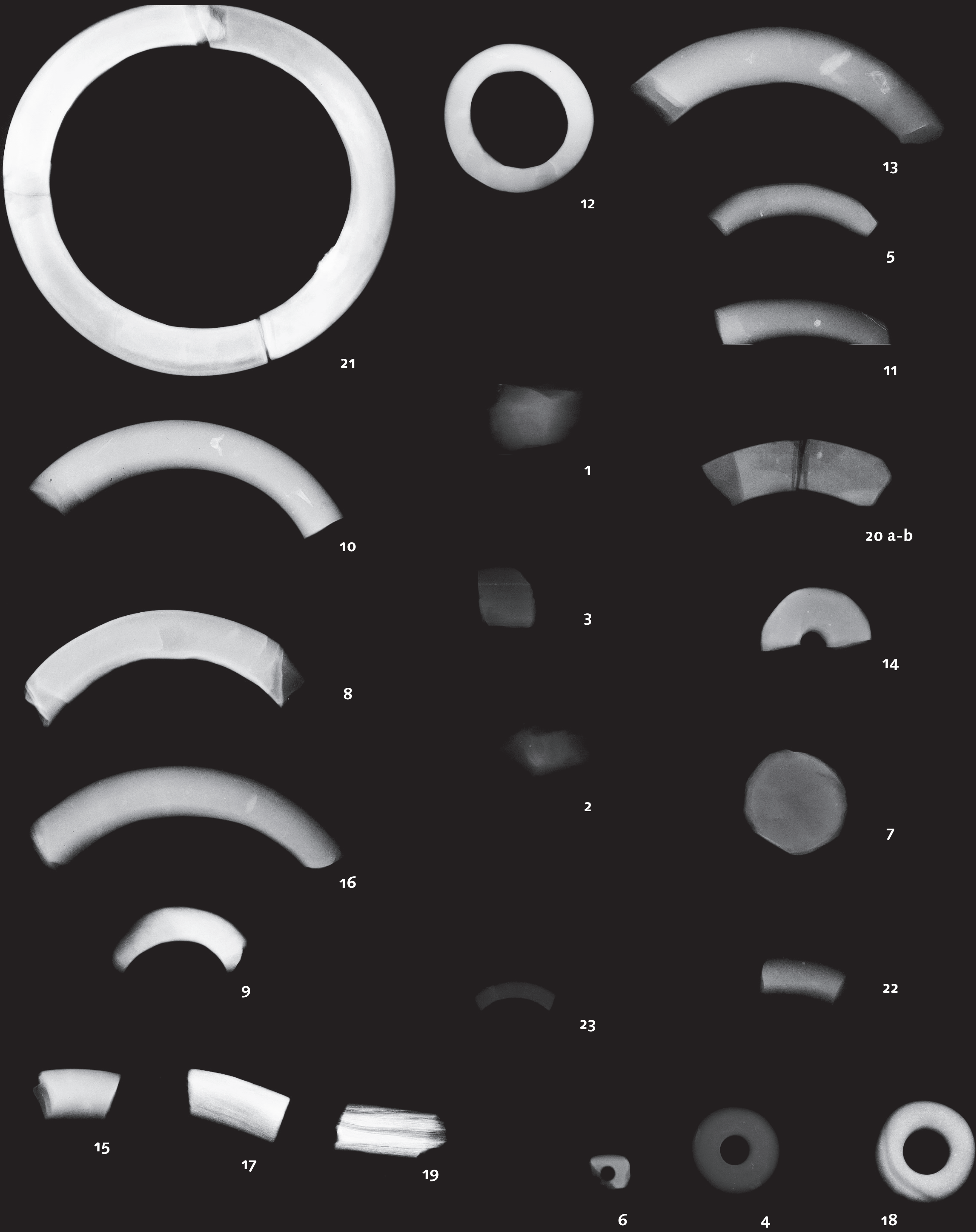

21
12
13
5
11
1
20 a-b
10
3
14
8
2
7
16
9
23
22
15
17
19
6
4
18

Figure 7.1 *X-radiographs of the jet and jet-like objects from Kaupang. Numbers refer to the Catalogue (Tab. 7.2). The objects' thicknesses in millimetres are:*
1: 10.3, 2: 14, 3: 10, 4: 3.4, 5: 6.8, 6: 2.5, 7: 5.5, 8: 8.6, 9: 9, 10: 8, 11: 6.2, 12: 4.6–7.2, 13: 3.9–7.8, 14: 5.5, 15: 9.9, 16: 9, 17: 10.4, 18: 3.5, 19: 9, 20: 6, 21: 11–16, 22: 4.3, 23: 1.6.

described by Heid Gjøstein Resi (this vol. Ch. 6:123–). Only a selected group of objects have been photographed (Fig. 7.3), but all objects are shown on the X-radiograph (Fig. 7.1). Dimensions can be obtained from the X-radiographs where they are rendered 1:1, for some also from figure 6.11 (Resi, this vol. Ch. 6). In the following text the objects will be denoted by their catalogue number (italicised, in brackets) listed in the first column in Table 7.2. Inventory numbers are given in the second column as well as in figure captions, but not in the text.

The investigation has been based on non-destructive analyses concerned primarily with the inorganic constituents. The study aimed to separate the black lithic materials excavated at Kaupang into three categories: jet, shale and intermediates. Traditionally, provenancing has frequently been based on assumptions and historical evidence and black lithic materials used for the manufacture of artefact have often been ascribed to the better known British sources: Kimmeridge for shale and Whitby for jet (Watts 1996:227). In the following, several methods will be evaluated and used to provide technical evidence for the provenance of the black lithic materials

7.1 Methods

X-radiographs were made using 40 kV and 5 mA for 60 seconds at a distance of 70 cm between object and X-ray tube. A 1 mm polyethylene sheet was placed between the object and the X-ray film.

XRF (X-Ray fluorescence) analyses were undertaken using a portable handheld Thermo Scientific Niton XL3t900 with fundamental parameter mining mode calibration[2].

Visual assessment was obtained with the aid of a binocular microscope 5 –40 x magnifications.

FTIR (Fourier-transform infrared) spectroscopy analyses were made with a Perkin Elmer spectrum v5.0.1. Samples were scanned 32 times over wave numbers 4000 cm^{-1} to 650 cm^{-1}, at resolution of 4 cm^{-1}.

SEM_EDX: (Scanning electron microscope – energy dispersive X-ray) analyses were made using a JEOL-JSM 840 microscope equipped with an X-ray analyser (INCA).

7.2 Results

The proportions of organic and inorganic material

In this work the fundamental parameters method (FP method), rather than the Compton method previously employed in archaeological contexts is applied. The Fundamental Parameter mining mode calibration used here quantifies a selection of elements with atomic numbers above Z=11: Sb, Sn, Cd, Pd, Ag, Ba, Mo, Nb, Zr, Sr, Rb, Bi,, As, Se, Pb, W, Zn, Cu, Ni, Co, Fe, Mn, ,Cr, V, Ti, Al, P, Si, Ca, K, Cl, S and Mg. These elements are measured directly via their appropriate characteristic X-ray lines .The sum of all unmeasurable elements are here contained in what is called a balance and they are measured indirectly using X-rays from the X-ray tube which are scattered off the sample.

The calculation of the balance is based on the intensity of incoherently backscattered X-radiation (Compton scatter) from the sample. When the sample is excited by an X-ray beam, in this case Ag-Kα radiation from the Ag tube, the respective Compton scatter peak is observed in the energy range 19.9 and 21.5 keV and is treated as a virtual element in this software. The method is based on all the elements analysed; both indirectly (balance) and the directly measured elements are normalized to 100%. Weight percentage balances (wt% balance) for the samples investigated are listed in Tables 7.1 and 7.2. As most

2 Fundamental parameter methods (FP) provide multi-site capabilities by eliminating the requirements for site-specific standards. Source: Max. 50kV Ag transmission target tube, Max. 2 Watt Max. 100 µA current. Tube current is driven to maximum value (100 uA) unless a dead time of max 55% in the detection system is reached. No combination of voltage, current and output can exceed the maximum values given above Primary beam filtration with 6-position filter wheel. Filter settings and voltage settings for mining mode: Filter LIGHT: No filter but polyimide film in front of the tube window (present for all filter settings). Voltage set to 6kV, maximum current 100uA. Helium purge light element analysis package extends the analytical range down to magnesium, Z=11. The instrument is equipped with a full-areas analysis (8mm) and small spot focus (3mm). – Filter LOW: Cu filter, voltage 20 kV, max 100 uA – Filter MAIN: filter stack of Fe and Al, 40 kV, max 50 uA – Filter HIGH: Mo filter, 50 kV, max 40 uA. Collimation of the primary beam is user-selectable to either 8 mm diameter (standard, covering full area of the measuring aperture) or to a small spot, 3 mm diameter. The detector is an Amptek SIPN, 6 sq mm, resolution of around 185 eV, count rate throughput c. 18 kcps.

Wt% balance	Estimated wt% organic material	% S organic bound	No. of objects	Zones
50–55	0–10		1	Shale
55–60	10–20		4	Shale
60–65	20–30		5	Shale
65–70	30–40		6	Shale
70–75	40–50		1	Intermediate
75–80	50–60		3	Intermediate
80–85	60–70		0	
85–90	70–80		0	
90	90+ organic S~95	Ca 5%	3	Jet and lignite

Table 7.1 *A rough estimate of wt% of organic material is based on the wt% balance adjusted according to the calculated inorganic bound oxygen.*

elements in an organic material will not be quantified, the wt% balance of materials with a high proportion of organic components such as true jet will be high. With some modification the wt% balance thus serves as a direct measure of the proportion of organic constituents. Materials such as shale contain significant proportions of oxides of clayey components and the wt% balance includes organic material as well as inorganic bound oxygen. A rough estimate of the proportion of oxygen in clay, based on its proportion in kaolin, is close to 50%. As clay is a major component in shale, the proportion of inorganic bound oxygen is assumed to correspond roughly to the wt% of the directly measured elements.

Thus if the wt% balance is 70%, 30% corresponds to the amount of directly measured elements and the proportion of inorganic bound oxygen is estimated to c. 30%; i.e. the wt% of organic material will be close to 40%, inorganic 60% (Tab. 7.1). Although the proportion of Fe may amount to c. 10% in several samples and contribute with a little less inorganic bound oxygen than clay, the rough calculations of the proportion of inorganic bound oxygen are related to the proportion found in kaolin for practical reasons. The SEM-EDX analyses below indicate that S in the jet zone is ascribed to the organic matrix and adds to the wt% of the organic proportion of these materials. This approach suggests that a wt% balance close to 50% would correspond to 100% kaolin or clay and has c. 50% inorganic bound oxide, while all wt% balances above 50% would include a proportion of organic material.

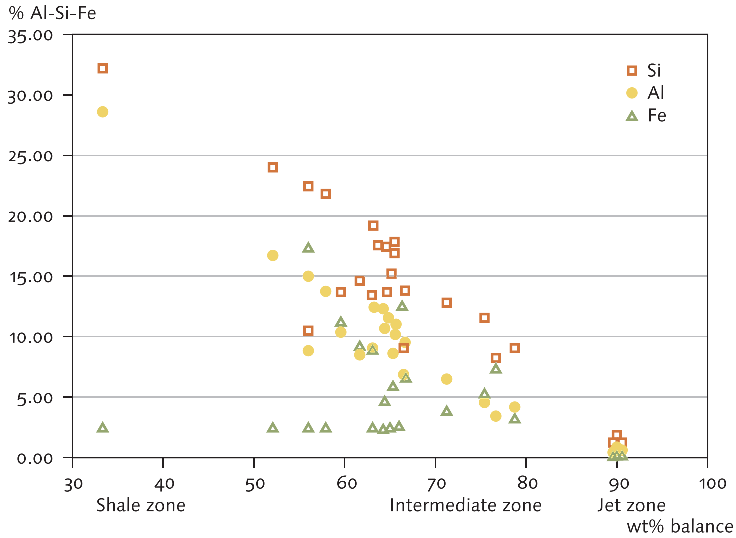
The small fragment of a finger ring (*23*) has wt% balance of 33%; this is much too low and the uncertainty of the measurements given is large. However, this balance is accompanied by Si and Al levels which appear to be much too high even if they indicate a substantial amount of clayey material. Probably because of the lower mass thickness of this object, the absolute intensity of backscattered radiation is significantly lower than for other objects with larger mass thickness. Consequently normalization leads to an underestimate balance and an over-estimate of the directly measured elements.

The non-quantified elements of interest above Z=11 observed in spectra are Ge, Y, U and Br and as they are present in only small quantities they do not interfere seriously with the wt% balance.

In the following discussion, wt% balance measurements are divided into three zones: the shale zone below 70wt% balance, the intermediate zone between 70% and 80%, and the jet zone above 80%. Objects to be found in the jet, shale and intermediate zones are here referred to as jet, shale and intermediates. In some cases it has been useful to refer to zones above 70% as the non-shale zone and in some instances the zone below 80% as the non-jet zone. Objects in Table 7.2 are ordered according to the decreasing values of the measured wt% balance.

Hunter (et al. 1993) suggested X-radiography as a quick and easy method to sort shale from non-shale due to differences in the proportion of inorganic components, giving rise to differences in X-ray opacity. Figure 7.1 shows the variation in X-ray opacity of the Kaupang objects and, allowing for varying thicknesses, the opacity reflects the proportion of inorganic materials: most important are the levels of Fe together with Al and Si, and the level of Fe obviously contributes considerably to opacity. The low X-ray opacity of the three lumps in the jet zone is evident. The differences in opacity are also marked when comparing objects of the intermediate and shale zones such as bead rings (*4*) and (*18*) or the two unfinished discs (*7*) and (*14*). Some objects such as armrings (*20*) and (*22*) have low opacity combined with a low wt% balance measurements. This is partially due to a low level of Fe as well. The low opacity of the finger ring (*23*) from Kaupang was considered due to a low level of Fe combined with its thinness and so it continues to be regarded as shale.

Figure 7.2 *Scatter diagram of Al, Si and Fe against wt% balance.*



These jet-like materials are not homogeneous. Inclusions of inorganic material show up in the X-radiographs as X-ray opaque particles, some more than 5 mm long, and confirm the non-homogeneous nature of this material. Inclusions are also visible to surface examination. This implies that the accuracy of the XRF analyses is not crucial and that measurements are considered to give approximate proportions. Nevertheless the percentages of quantified elements are listed in Table 7.2.

XRF analyses and the distribution of elements

Most elements quantified in the program vary in such a manner that they could not be used as discriminating elements. It also seems possible that levels of elements such as Pb and Cu are the products of contaminants from the environments in which the objects were found. The armring (*21*), the only burial find within this group, contains a variety of minor and trace elements such as Pb, Cu, Ni and Co, all assumed to derive from the environment. This applies also to the very high content of Fe (17%) found in this object. The high levels of Fe in finger ring (*9*), armlet (*17*), bead (*18*) and armring (*19*) may partially be due to contamination as well. Potentially discriminating elements selected for the Kaupang assemblage are S, Si, Al, Si and Rb while, in recognition of irregularities due to contamination, Fe was also selected.

As illustrated in Table 7.2, marked differences are found in the Fe and S levels in objects of the jet and the non-jet zones. The lumps (*1, 2* and *3*) in the jet zone contain less than 0.1% Fe while the content of S is high, between 5% and 7%. Objects in the shale and intermediate zones have high Fe levels, varying mostly between from 2.3% to 11.2%, while the S levels are relatively low, less than 2.5%. Some pyrite was expected in objects of the non-jet zones, but the proportion of Fe to S suggests that only a minor quantity of iron can be assigned to iron sulphide.

The scatter diagram (Fig. 7.2) shows the Al, Si and Fe levels against the wt% balance. The diagram reveals low levels of all three elements in the jet zone and increasing levels against decreasing wt% balance in the non jet zones. This corresponds to the increasing proportion of inorganic materials revealed in the X-radiographs and the wt% balance. The scatter diagram demonstrates less steady an increase in levels of Fe compared to Al and Si levels as the wt% balance decreases.

Sr and Zr are present in objects of all three zones in various concentrations and it appears that they may not function reliably as discriminating elements. Interestingly the lump (*3*) of the jet zone contains a high level of Zr, much higher than any of the other samples analysed. Together with a low level of Fe, high V level and a quantity of Zn, the elemental composition may appear to bear some resemblance to Whitby jet, possibly the only one in this investigation (Davis 1993:15). A small amount of Rb is present together with Sr and Zr in all but two objects (*21*) and (*14*) within the non-jet zone – and was not detected in the three lumps (*1, 2* and *3*). At present, it may seem that the occurrence of this triplet, Sr, Zr and Rb, is specific to non-jet objects. All four objects in the intermediate group (*4, 5, 6* and *7*) contain Rb together with Zr and Sr and may perhaps be classified as oil-rich shale or cannel coal/oil shale. Br is not quantified in the programme and must be identified and quantified from the spectra. It occurs in small amounts in lumps (*1*) and (*2*) and is only detected in sample (*20a*) of the non-jet zone.

Visual assessment

Mary Davis (1993) discusses the different characteristics of black lithic materials used as artefacts. She points to the concoidal fracture surfaces of jet and cannel coal and the non-concoidal fractures of shale. It is also obvious that shale with its laminated structure tends to delaminate, while jet and cannel coal are more compact with a glassy character. Jet, as fossilized wood, has retained its wood structure while cannel coal, although compact, has a fine layered structure. Lignite, like jet, also derives from wood and has retained a woody structure but has a non-concoidal fracture. The higher rank of black lignite for Viking-period artefacts uncovered at Shetland was recently published by Hunter (2008). All these black lithic materials may be given a smooth and shiny polish which is more brilliant and probably more long-lasting on jet than on shale.

Shale: The layered structure of shale with natural cleavage planes facilitates the making of artefacts but represents a weakening that can give rise to rupture as well (*21*; Fig. 7.3.a).Sixteen objects are categorised as shale, including finger rings, armrings, discs and beads They all have crack patterns parallel to the circular plane indicating that they were formed from a slab or a slice, shaped by splitting the raw material along the natural plane of cleavage (Sheridan et al. 2002:823–4). This explains why eight of the twelve armrings examined have split. The fracture surfaces are flat with a shale-like texture (*13*; Fig. 7.3.b). The bead-ring (*18*) with a smooth front face has no visible cracks but the split, untooled reverse face indicates a layered structure (Fig. 7.3.p–q). Three fragments (*5*, *17*, *19*; Fig. 7.3.e, c and d) have not split. The fracture surface of these fragments is compact and the laminar structure less obvious, suggesting that they were made from cannel coal rather than shale. According to wt% balance, however, only fragment (*5*) was considered a cannel coal/oil shale type of material while the other two were regarded as oil shale.[3] More accurate analytical measurements may throw further light on the identify of these fragments.

Intermediates: Four objects, beads (*4*, Fig. 7.3.j–k) and (*6*), a disc-bead (*7*, Fig. 7.3.l–m) and an armlet (*5*; Fig. 7.3.e), are placed in the intermediate zone. No concoidal fracture surfaces were observed, but a layered structure parallel to the circular plane is visible. The smoothly finished bead (*4*) as well as the unfinished disc (*7*) have visible cracks parallel to the circular plane. A layered structure is visible in the fracture surfaces of the small bead (*6*) and armlet (*5*; Fig. 7.3.e). This suggests that these objects may be classified as cannel coal/oil shale.

Jet: Concoidal fractures and smooth bulging fracture surfaces observed on two lumps (*2* and *3*) are assigned to the glassy nature of jet (Fig. 7.3.s–t). One lump (*1*; Fig. 7.3.r) reveals no concoidal fracture but cleavage surfaces with a fibrous texture are observed on all three lumps and can plausibly be ascribed to the fossilised wood. Weaknesses giving rise to preferential ruptures such as the laminar cleavages in shale are absent. Spontaneous single cracks unrelated to the wood structure are formed consistent with the glassy nature of this material. The two lumps (*2*) and (*3*) have the appearance of jet while lump (*1*), if not jet, may be lignite.

Figure 7.3 *Selected jet-like objects from Kaupang. Not to scale. For dimensions, see Table 7.2.*
***a**. Delaminating structure of armring. **b**. Smooth surface of armring and flat split surface of armring. **c**. Cross-section of armring. **d**. Cross-section of armring. **e**. Cross-section of armring. **f**. Tooled fracture surface of finger ring. **g**. Tooled cross-section of finger ring (re-whittled?). **h**. Whittled surface of armring (re-whittled?). **i**. Tooled and unfinished surface of finger ring. **j**. Smoothed surface of the front face of bead-ring. **k**. Smoothed surface of the reverse face of bead-ring. **l**. Split surface of unfinished disc. **m**. Tooled edges of unfinished disc. **n**. Split surface of unfinished broken disc-bead. **o**. Tooled outer edge of unfinished broken disc-bead and layered fracture surface of unfinished broken disc-bead. **p**. Polished front face of bead. **q**. Split untooled reverse face of bead. **r**. Unworked lump with rough, indistinct surface. **s**. Unworked lump with concoidal fracture surface, wood structure visible. **t**. Unworked lump with concoidal fracture surface.*

Unfinished surfaces are recognized on six objects (*1, 2, 3, 7, 14*, and *20a and b*, Fig. 7.3.r, s, t, l, m, n and o). The first three comprise the unworked lumps of raw material (Fig. 7.3.r–t). The two disc-shaped objects (*7* and *14*) are rough-outs (Figs. 7.3.l–o) with split upper and lower faces left unfinished and whittled edges. Disc (*14*; Fig. 7.3.e) has broken across the centre hole of the circular disc. Small fragments (*20 a* and *b*) have split upper and lower surfaces. Finger ring (*12*; Fig. 7.3.i) is left with a roughly tooled surface. The unfinished disc (*7*) may have been intended for something like a disc-bead.

The profile of half cross-sections and full sections suggest that most armrings were made with an ovoid cross-section, slightly more curved on the outer than the inner side towards the arm (Fig. 7.3.c, d and g) with a ridge formed where the inner and outer slopes meet. Only the armring from a grave (*21*; Fig. 7.3.a) has a D-shaped cross section. Finger rings, (*9*) and (*12*), however, appear to have a D-shaped section (Fig. 7.3.f, g and i) associated with the need to fit the finger. The armrings appear to be mostly carefully smoothed.

3 Fraser Hunter suggests that visual characteristics of fragment (19), such as its compact nature and the fine laminar structure, may point to cannel coal rather than shale. Indeed the very fact that this piece is broken rather than split supports this view.


a. Cat. no. 21


b. Cat. no. 13

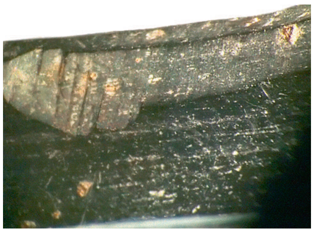

c. Cat. no. 17


d. Cat. no. 19


e. Cat. no. 5


f. Cat. no. 9


g. Cat. no. 9


h. Cat. no. 16


i. Cat. no. 12


j. Cat. no. 4


k. Cat. no. 4


l. Cat. no. 7


m. Cat. no. 7


n. Cat. no. 14

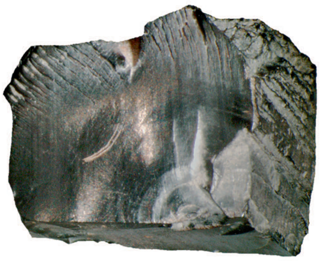

o. Cat. no. 14


p. Cat. no. 18


q. Cat. no. 18


r. Cat. no. 1


s. Cat. no. 2


t. Cat. no. 3

Whittled surfaces can be observed on the armring (*16;* Fig. 7.3.h) and on the finger ring (*9*; Fig. 7.3.f). The armring (*16*) may have been re-whittled at some time after its manufacture. For some reason the fracture across the finger ring (*9*) has been tooled (Fig. 7.3.g), indicating that this object was reworked after it had broken.[4] As mentioned above the finger ring (*12*; Fig. 7.3.i) has a black and shiny finish but an uneven whittled surface; the ring looks unfinished. The whittled surfaces indicate that to some extent objects were hand-shaped. Whether or not the armrings with smooth surfaces were turned or hand-shaped by whittling before the final trimming and polishing were undertaken cannot be confirmed.[5]

Lump 1964 5h–5i (*2*): FTIR and SEM_EDX analyses

FTIR-ATR analyses were obtained from a powdered fragment which had separated from the un-worked lump labelled (*2*), found in the envelope where it was contained. Watts (1996:201) has classified materials as jet when the spectra show a shoulder attributed to aromatic ring stretch at 1500 cm^{-1}, and a prominent aromatic C-H deformation at 815 cm^{-1}. Both of these absorptions are present in the infrared diagram of the sample from object (*2*) indicating the presence of jet. The C=O stretch absorption at 1700 cm^{-1} shows that some oxidized material is present. This could point to lignite rather than jet, or jet with a small proportion of oxidized material not unexpected in archaeological material. The strong absorption at 1600 cm^{-1} is assigned to aromatic stretch thought to be enhanced by phenol groups which are present and characteristic of vitrinite-rich coals such as jet and cannel coal but not in shale.

After FTIR-ATR analyses had been done, the powdered fragment from the ATR stage was picked up with carbon tape and transferred to the electron microscope (SEM) equipped with energy dispersive X-ray (EDX) analyser. The sample was not sputtered with carbon but the intimate contact between powdered sample and the carbon tape provided acceptable conditions for analyses. BSI imaging and EDX-analyses revealed discrete particles of inorganic matter (alum, gypsum and particles composed of Fe, Cr and Ni) in the organic matrix, while in certain zones S was observed as an evenly distributed matter in the organic matrix. The contents of Zr, Zn and V detected with the handheld XRF analyser were missed using the SEM-EDX. As the handheld XRF instrument analyses an area 10 mm in diameter while SEM-EDX analysis is of an area only c. 2 µm (2/1000 mm) in diameter, some of the elements scattered in the organic matrix will be overlooked. The high level of S seems to be an integrated part of the organic matrix and therefore is easily detected.

Figure 7.4 *The FTIR spectrum, upper curve, was obtained from sample bopl.1964 5h–5i (2), and peak identification was aided by the second derivative spectrum (second order, 37 points), lower curve. Aromatic ring stretch at 1500 cm^{-1}, and a prominent aromatic C-H deformation at 815 cm^{-1}, suggest the presence of true jet.*

7.3 Related material

Scientific analyses of jet and jet-like materials have mostly been carried out on artefacts from periods before the Viking Age. In the following, therefore, the Kaupang assemblage will be related to the results from these studies as well as recent scientific analyses of a selection of eleven objects of the 12th–16th centuries found in Norway.

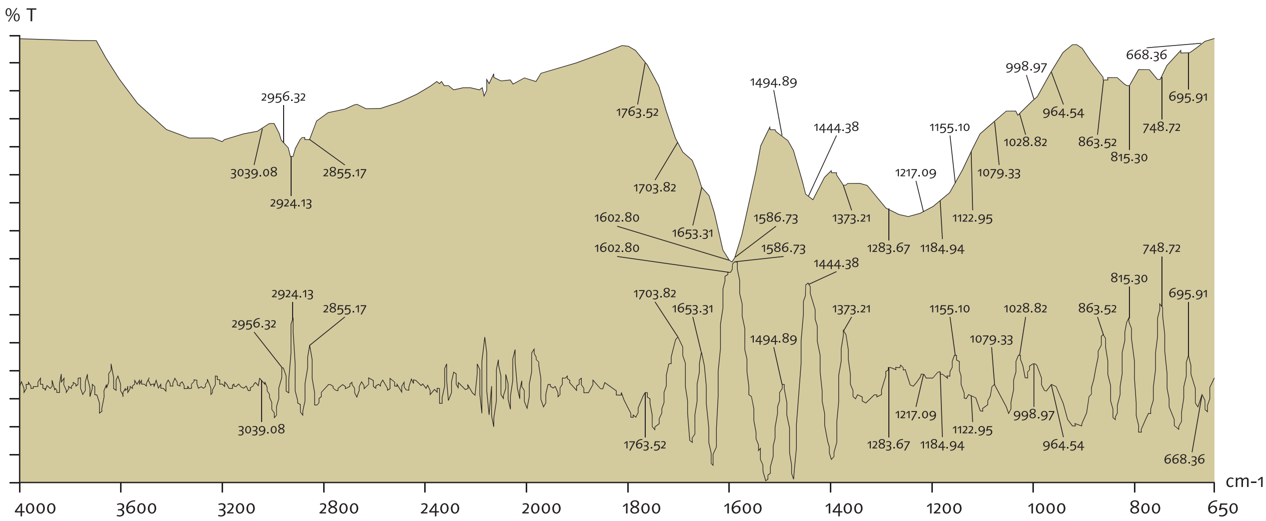
Most relevant are the results from Hunter's (2008) newly published scientific study of Viking-period jet-like materials in Scotland. The Viking-period objects analysed by Hunter derive mostly from Orkney and Shetland, where these materials had to be imported. Using much the same methods for analyses as described in this paper, Hunter found that jet was rare, and lignite and cannel coal were favoured. He finds no evidence of lathe-turning and that objects may rather have been hand-shaped with knives. Both finished and unfinished items were found suggesting that the Viking populations in Shetland and Orkney manufactured jet-like jewellery of imported raw materials occurring in Scotland. The absence of discs that could have been removed from the centre of rough-outs suggests that perforation was made by starting with a small hole.

Heid Gjøstein Resi (2005) has published a survey

4 Fraser Hunter (pers. comm.) remarks that this is a common feature where there is a shortage of this type of raw material and that it might have been intended for a bead or a pendant

5 Hunter (2008:107) observed hand-shaped artefacts rather turned on Viking-period items uncovered in the Orkneys and Shetlands.

6 Medieval artefacts from the collection of Museum of Cultural History, University of Oslo: C32376h, C31902r, C15340qIV, C34020_3 (large), G17679, G17544–45 Large, C33227b, C31902w and G14066.



with illustrations, at scale 1:2, of 'jet' finds in Norway from the Viking and medieval periods which includes a number of the selected eleven objects analysed from later medieval periods. She discusses the different qualities of 'jet', possible sources, and the types of object. These studies are based on surface examination with the limitations this type of analysis may lead to. The recent analyses of the 12th- to 16th-century objects were carried out by the author using the same methods as described above.[6] Nine objects were categorized as jet and two as intermediate. None of these objects contained Rb but, consistent with jet, most of them contained high levels of S, low levels of Fe and, unlike the Kaupang items, several pieces of jet contained Ge: this includes the two beads classified as intermediates. According to Watts (1996:98) Kimmeridge jet contains Ge rather than Whitby jet, suggesting that the Norwegian medieval finds could have derived from a Kimmeridge source rather than Whitby. Watts has, however, shown that Ge is not unique to Kimmeridge jet and it has been argued that it is an unreliable discriminator, susceptible to enrichment caused by ion exchange mechanisms during its burial condition (Watts 1996:110–11). Nevertheless it does seem more than coincidence that six out of the eleven later medieval objects uncovered in diverse places in the southern parts of Norway contain a small content of Ge while none of the Kaupang objects do.

All the medieval beads analysed were small, less than 2 cm in the largest dimension. The unworked lumps (*1*), and (*2*) and (*3*) from Kaupang are between 1 and 2 cm in the largest dimension and the lumps would have been quite suitable for making beads. The bead-like objects (*4*), (*6*) and disc-bead (*7*) at Kaupang are small, also less than 2 cm in diameter, but do not appear to have been made of true jet like the medieval beads but perhaps in a variety of cannel coal/oil shale. Looking at the Kaupang assemblage and the medieval beads, it is conceivable that shale was preferentially selected for making armrings while jet was selected for the smaller objects such as beads. According to Lindsay Allason-Jones this is also true of Roman assemblages. Watts, however, maintains that shale is not necessarily inferior to jet and, like jet, may be suitable for carving details, but it is only the very oil-rich shales like the Kimmeridge blacks that give a high polish. In her study of black lithic materials from Roman York and Verulamium (Watts 1996:236–5), she found that the manufacture and distribution of black lithic material indicate that the craftsman would have accepted whatever workable material was available. In the assemblage from Kaupang shale was definitely dominant, perhaps indicating that it was more easily available than jet. It may be relevant that shale would normally have been available in larger pieces, sufficient for shaping armlets, while the small pieces of jet and the most organic-rich material were available in smaller pieces and shaped as beads. Both Hunter and Allason-Jones can verify that jet was traded in smaller lumps, suitable for making beads.[7]

Only the fragmented object (*5*) of the cannel coal/oil shale type seems to have been shaped as an armlet. In addition to the medieval examples, one

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Table 7.2 *XRF analyses of a selection of elements, listed according to decreasing wt% balance: i.e. increasing proportions of the inorganic material in the composition. All objects are shown in Figure 7. 1 in addition to the figures mentioned in Column 3. In columns 4 the following abbreviations are used: D. = diameter; L. = length; Th. = thickness; W. = width; Wt. = weight. Measurements are in millimetres, weight in grammes. Measurements (Column 4) are made by Heid Gjøstein Resi (this vol. Ch. 6).*

Cat. no.	Inventory no.	Fig. nos.	Object
1	C. 1962 ii	7.3.r	Lump. Untooled, fibrous. L. 23, W. 14, Th. 13, Wt. 2.5
2	1964 5h–5i	7.3.s	Lump. Untooled fibrous. Concoidal fracture. L. 20, W. 18, Th. 10, Wt. 1.4
3	C52519/18604	6.11.8 7.3.t	Lump. Untooled fibrous. Concoidal fractures. L. 12.8, W. 11.4, Th. 10.3, Wt. 1.3
4	1966 MO. 9h–9p	7.3.j–k	Bead/ ring. Polished on all sides, narrow cracks parallel to the circular plane. D. 18, D. (hole) 5.3, Th. 3.4, Wt. 9
5	C52517/1360	6.11.1 7.3.e	Armring (broken). Oval section, layered parallel to the circular plane, compact. Fragment: L. 34, W. 8.9, Th. 6.8, Wt. 1.8. Ring: D. (outer) 61, D. (inner) 50
6	C52519/11840		Bead (broken). Small and square. Polished on all sides. Layered parallel to the circular plane fracture. D. 8.4, D. (hole) 2.4, Th. 2.5, Wt. 0.2
7	C52519/11096	6.11.7 7.3.l–m	Disc/bead, (a rough out). Circular disc with untooled split surfaces and tooled edges. D. 18.8–20.7, Th. 5.5, Wt. 2.4
8	C52519/9619		Armring (split). Oval section, smooth finish on the outer side, whittled on the inner. Layered, parallel to the circular plane. Inclusions visible. Fragment: L. 55, W. 9.8, Th. 8.6, Wt. 5.5. Ring: D. (outer) 74, D. (inner) 56
9	1962 square V2	7.3.f–g	Finger ring (broken). D section, a groove runs along the summit of the curved outer surface. Whittled all around. Flat on the inner side. Tooled with a knife (?) in the fractured cross-section. Layered parallel to the circular plane. Inclusions visible. Fragment: L. 28, W. 7, Th. 9. Ring: D. (outer) 40, D. (inner) 25
10	C52516/3856	6.11.2	Armring (split). Oval section. Smoothed on inner and outer sides. Layered, parallel to the circular plane. Inclusions visible. Fragment: L. 60.2, W. 10, Th. 8, Wt. 6.4. Ring: D. (outer) 75, D. (inner) 56
11	C52519/10967		Armring (split). Oval section, smooth finish. Layered, parallel or slightly angular to the circular plane. Fragment: L. 35, W. 9, Th. 6.4, Wt. 1.4. Ring: D. (outer) ?, D. (inner) 70
12	1959 BO. aaa	7.3.i	Finger ring. Whittled unfinished surface. Black and shiny. W. 4.9–5.8, Th. 4.6–7.2, Wt. 3. Ring: D. (outer) 27–30, D. (inner) 17–20.7
13	C52519/9760	6.11.3 7.3.b	Armring (split). Oval section, smooth outer side, whittled inner side. Layered parallel to the circular plane. Inclusions visible. Fragment: L. 62.2, W. 10–11.3, Th. 3.9–7.8, Wt. 5.3. Ring: D. (outer) 80, D. (inner) 60
14	C52519/9907	6.11.6 7.3.n–o	Bead (a rough-out, broken). Centre hole with smooth sides (turned?). Untooled split surfaces, tooled outer edges. Layered fracture surface and cracks parallel to the circular plane. Some inclusions visible. D. 21.6, D. (hole) 4.5, Th. 5.5, Wt. 1,3
15	C52519/9898		Armring (split). Oval section, smooth finish. Outer side slightly more curved than inner. Layered parallel to the circular plane. Inclusions visible. Fragment: L. 17.3, W. 10, Th. 9.9, Wt. 1.6. Ring: D. (outer) 90, D. (inner) 70
16	K 1970 m	7.3.h	Armring (split). Oval section, whittled and smooth finish. Layered parallel slightly angular to the circular plane. Inclusions visible. Fragment: L. 6.1, W. 9–11. Ring: D. (outer) 80, D. (inner) 60
17	C52519/1861	7.3.c	Armring (broken). Oval section Outer side slightly more curved than inner. Layered parallel to the circular plane. Fragment: L. 20.8, W. 6.7, Th. 10.4, Wt. 1.6. Ring: D. (outer) 66, D. (inner) 54
18	C52519/19807	6.11.5 7.3.p–q	Bead (split). Smooth on the front face. Compact. Split and untooled surface on the reverse. Layered structure not evident. Inclusions visible. D. 20.1, D. (hole) 8.7, Th. 3.3–3.8, Wt. 1.2
19	C52519/12024	7.3.d	Armring (broken). Oval section, outer side slightly more curved than inner. Smooth finish. Layers parallel to the circular plane. Inclusions visible. Fragment: L. 23, W. 7, Th. 9, Wt. 1.5. Ring: D. (outer) 76, D. (inner) 64
20a	C52517/1167		Armring (split). Untooled flat top and bottom. Layered, parallel to the circular plane. Fragment: L. 37, W. 10, Th. 6, Wt. 2.2. Ring: D. (outer) 80, D. (inner) 60
20b	C52517/1167		
21	Ka. 218a	7.3.a	Armring. D-shaped section, smooth finish. Layered parallel to the circular plane, cleavages. Inclusions visible. W. 8.9–9.6, Th. 11.4–16.3, Wt. 19.2, D. (outer) 73.4–75.8, D. (inner) 54–57.7
22	C52519/11154		Armring, (split). Oval section, smooth finish. Layered parallel to the circular plane. Fragment: L. 18.2, W. 8.1, Th. 4.3, Wt. 0.7. Ring: D. (outer) 70, D. (inner) 56
23	C52519/11183	6.11.4	Finger ring (split). Smooth mat. Thin, layered parallel to the circular plane. Fragment: L. 16.5, W. 3.2, Th. 1.6, Wt. 1.0. Ring: D. (outer) 20.6, D. (inner) 20

% wt Bal	%Fe	%S	%Al	%Si	%Zr	%Rb	%Sr	%V	%Ca	%Zn	Proposed material
91	0.11	**5.7**	0.42	1.19	0.008	0	0.018	**0.11**	0.51	0	Jet/lignite
90	0.10	**4.8**	0.82	2.02	0.007	0	0.058	0.016	0.70	0	Jet
90	0.04	**6.7**	0.30	1.2	**0.060**	0	0.03	**0.34**	0.63	0.097	Jet
79	3.3	1.3	4.1	8.9	0.025	0.004	0.088	0.046	**1.2**	0.008	Cannel/coal /oil shale
77	**7.3**	1.2	3.6	8.2	0.008	0.002	0.075	0.065	0.80	0.048	Cannel/coal /oil shale
76	**5.4**	0.71	4.5	**11**	0.009	0.007	**0.11**	0.022	0.53	0.030	Cannel/coal /oil shale
72	3.9	1.3	6.5	**13**	0.013	0.002	0.10	0.032	**1.7**	0.046	Cannel/coal /oil shale
67	**6.6**	1.1	9.5	**14**	0.022	0.003	0.061	0.049	0.40	0.016	Oil shale
67	**13**	2.4	6.7	8.9	0.007	0.002	0.039	0.035	0.78	0.020	Oil shale
66	2.6	0.74	**11**	**18**	0.021	0.004	0.095	0.079	0.60	0.010	Oil shale
66	2.7	1.1	**10**	**17**	0.019	0.004	**0.24**	**0.26**	0.66	0.013	Oil shale
66	**5.9**	1.6	8.5	**15**	0.011	0.005	0.095	0.031	**1.5**	0.017	Oil shale
65	2.5	1.3	11	**17**	0.019	0.003	**0.15**	**0.26**	0.50	0.007	Oil shale
65	4.7	1.2	11	**14**	0.031	0	**0.11**	0.036	1.9	0.030	Oil shale
64	2.4	0.90	12	**18**	0.025	0.003	**0.16**	**0.16**	0.61	0.013	Oil shale
63	2.5	0.68	**12**	19	0.026	0.004	0.095	0.107	0.50	0.008	Oil shale
63	**9.0**	2.7	9.1	13	0.010	0.002	0.124	**0.13**	0.73	0.028	Oil shale
62	**9.3**	3.0	8.5	15	0.013	0.002	0.048	0.064	0.90	0.026	Oil shale
60	**11**	1.9	**10**	14	0.010	0.003	0.057	0.053	**1.4**	0.037	Oil shale
58	2.5	0.62	**14**	**22**	0.022	0.005	0.076	0.048	0.75	0.011	Oil shale
57	2.6	0.72	**15**	**22**	0.024	0.005	0.084	0.056	0.72	0.010	Oil shale
57	**17**	2.0	8.6	10	0.009	0	0.061	0.062	**2.9**	0.051	Oil shale
53	2.7	0.91	**17**	**24**	0.032	0.005	**0.17**	0.095	0.78	0.015	Oil shale
34	2.5	0.48	**28**	**32**	0.032	0.007	**0.23**	0.058	**1.2**	0.020	Oil shale

separate intact bead ring uncovered at Svennevig, Hommedal, Aust-Agder (C1972), near the south coast of Norway, dated to the 8th century, was analysed (Resi 2005). A low level of S and appreciable levels of Fe together with a small amount of Rb as well as cracks parallel to the circular plane suggest that this is not jet but perhaps a cannel coal/oil shale type of material. This matches the appearance and composition of the Viking-period beads at Kaupang.

Using coal petrological methods combined with palynological methods, Marlies Teichmüller (1992) has identified black lithic objects deriving from periods within a long period ranging from c. 1000 BC to the 4th century AD. She finds that shale outcropping at Kimmeridge in Dorset and "Schwartz" outcropping in northern Bohemia are the most workable raw materials in England and on the Continent. Teichmüller found that both these sources served as raw material for artefacts uncovered on the Continent. That Kimmeridge shale was identified in a large proportion of artefacts uncovered on the Continent indicates frequent trade across the Channel.

Reflected light microscopy was not used for the identification of the Kaupang assemblage but should be considered in future work on this type of material. The method requires sampling and cross-sectioning, but samples are small and the method is considered quick and simple. It has been used for many years by metallurgists and was subsequently taken up by the geologists and applied in the study of coal petrology. The reflection measurements (%Ro) are indicative of both types and sources of coal and the method has been successfully applied by Allason-Jones and Jones (2002) for the identification of jet and jet-like artefacts from the Roman Period uncovered in Britain and on the Continent. Allason-Jones and Jones found that a wide variety of material was used for black artefacts. Apart from a range of sources in England, raw materials were extracted from sources in Germany, Hungary, France and Spain to be used for making jewellery and other small artefacts. Analyses indicate that the centre for jewellery manufacture at South Shields did not depend on local sources; rather, being a port, supplies were imported from several sources. The authors also found that craftsmen attached more importance to the workability of the raw materials than their source, and found some preference for particular materials to make specific types of object: "pins were frequently made from jet, while armlets were made from shale and finger rings and beads from cannel coal" (Allason-Jones et al. 2001:244). These preferences were related to differences in the mechanical properties of the black material: "Cannel coal, with its tendency to shatter, may have been considered more appropriate for smaller objects, whilst shale being stronger and thus able to take the heat and stresses of lathe-turning, was more suitable for armlets" (Allason-Jones et al. 2001:244). They also pointed to the availability of larger quantities of shale: so large that shale could be used for table tops.

7.4 Conclusions

Only the three lumps were found to be true jet or lignite. The high proportion of organic material, a relatively high level of S and a low level of Fe support this view. The concoidal fractures characteristic of the glassy nature of jet helped classify the two lumps (*3* and *2*) as jet. The surface texture of lump (*1*) suggests lignite rather than jet. The FTIR absorptions of lump (*2*) are indicative of true jet and SEM-EDX indicated the presence of S as an integratal element in the organic matrix. Differences in the levels of Zr, Zn and V suggest that the lumps possibly derive from different sources and the high levels of Zr, Zn and V in lump (*3*) could, as mentioned above, indicate the presence of Whitby jet (Davis 1993:15) while lump (*2*) could perhaps be associated with Spanish jet. (Mitchell et al. 2001:117–21). Nevertheless the uncertainties related to the variability within the deposits of black lithic materials make definite attributions difficult (Watts 1996:81). The possible occurrence of lignite may well reflect ties to the activities recorded by Hunter at the Viking-period settlements in Scotland, especially in the Shetlands, where lignite artefacts were dominant (Hunter 2008).

The remaining twenty objects were classified as non-jet; four of these were identified as organic rich materials and categorised as cannel coal/oil shale, the rest as oil shale.

A high proportion of clayey material, the layered structure, non-concoidal fractures, a high level of Fe and a low level of S as well as a small amount of Rb were all suggestive of shale. The rather high proportion of siliceous matter compared to calcium com-

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7 Fraser Hunter and Lindsay Allason-Jones, pers. comm. Allason-Jones, write: "The (Kaupang) blocks are very similar to those which we found at South Shields. It is possible that the Roman/Viking/medieval jet was being sourced from the beach and therefore didn't come in large sheets. … The blocks at South Shields, however, tend to be rectangular brick shapes or thick discs, which had clearly been shaped by tools into useful shapes and sizes before being transported to other sites. This suggests a formalised trade from the source to the workshops."

8 Fraser Hunter suggests that visual characteristics such as the compact nature and little laminar fracture of this sample may point to cannel coal rather than shale. Indeed the very fact that this piece is broken rather than split supports this view. As the sample as well was too small to cover the test area during the exposure the wt% balance measurement may in this case have been unreliable.

pounds classifies the material as a siliceous type of shale. Kimmeridge oil shale is classified as a siliceous oil shale and contains some carbonates as well. The shale objects at Kaupang contain a small amount of Ca (less than 1%) and may therefore include a small amount of carbonate. The content of organic material suggested by the wt% balance measurements is usually high enough to meet the requirements for shale to be used for carving artefacts (Watts 1996:30). Based on the high proportion of organic material in the four objects of the intermediate zone, the presence of Sr, Zr and Rb, and high levels of Fe and low levels of S, all support the classification of this material as cannel coal/oil shale.

All but one armring have come from the settlement. The objects are fragmented and most of them have split along cleavage planes. Interestingly, the only armring which has survived in one piece was the grave find (*21*), also the only armring with a D-shaped cross-section. According to Hunter, a common feature of this type of material is the frequency of split fragments, normally considered to have been lost in use. The Kaupang fragments were found spread over most of the settlement, indicating that they had split during use. The finger ring (*9*) was, however, tooled on the fracture surface. Hunter (2008:114) also refers to a reworked fragment, perhaps intended to form a tusk-shaped pendant

Considering the rough-out discs (*7*), and the broken unfinished disc bead (*14*), together with the unworked lumps, it may be argued that the jet-like artefacts at Kaupang, possibly beads alone, were not only traded ready-made but were also manufactured on a minor scale at Kaupang. Black lithic materials suitable for making artefacts do not occur in Norway and would have had to have been imported, which could easily have been the case at a port like Kaupang. Hunter argues that craftsmen working with amber would have been able to work with jet-like material as well (2008:108). Resi (this vol. Ch. 6:125) finds that the archaeological context suggests that this may well have happened at Kaupang.

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Gemstones: Cornelian, Rock Crystal, Amethyst, Fluorspar and Garnet

8

HEID GJØSTEIN RESI

Gemstones from the excavations of 1998–2003, together with the available material from earlier investigations of the settlement and burials at Kaupang, are assessed in terms of the character, quality and purpose of the material and its working. A selection of rock crystals and pieces of quartz is examined in the hope of uncovering evidence of the local manufacture of beads. All of the finds in each category of mineral have been identified as far as possible in terms of form, crystallinity, refractive index, colour, polishing, and the drilling of holes.

Polished beads of cornelian are usually interpreted as imports to Scandinavia from the Far East. This is also the case with rock-crystal beads polished to the same shapes as the cornelian beads. Rounded rock-crystal beads appear in more irregular forms than the cornelian beads, and beads of this material were produced in Scandinavia.

The finds assemblage consists of 43 finds of cornelian (42 beads and one stone for mounting), 54 beads of rock crystal, 2 amethyst beads, 2 fluorspar beads and 5 garnet crystals. There is also a larger quantity of rock crystals and of pieces of quartz and quartzite. Cornelian beads are found in five different forms. Two-thirds of them are very regular in shape. Most are red, although five have been scorched and so are white. At least two stages in the work of polishing can be observed. Attempts had been made to remove dark inclusions close to the surface. The majority of the perforations were drilled from two sides, but four from just one side. Where the two drilled holes met poorly there is evidence of a narrower drilled perforation to join them. Three cornelian beads on which the drilled holes did not meet may be failed items that arrived with supplies from overseas, or were to be used or fastened in some other way than stringing on a thread. The majority of the beads are of high quality.

Rock-crystal beads occur in seven different forms. Around half of them are spherical. The majority of the beads are very regular in form. Only a small number of spherical beads are irregular in shape or have an uneven surface. Up to three stages in the work of polishing can be observed, and evidence of three different abrasives. The majority of the perforations were drilled from two sides although there are quite a lot from just one side. In more cases than with the cornelian beads, two opposed drilled holes are linked via a narrower bore. Some fragments of large crystals are interpreted as possible raw material for working in Kaupang, but the purpose is not certain.

There are two beads of amethyst, one a drilled pebble, the other shaped, well-polished, and drilled. There are two fluorspar beads which are drilled pebbles. The five crystals of garnet are unsuitable for use in jewellery but may have served as an abrasive.

A total of 57 finds of cornelian have been recorded from Kaupang (56 beads and 1 stone for mounting), 43 of which could be included in this study (42 beads and the stone for mounting). There are 59 rock-crystal beads, of which 54 could be included in this study. There is also a large number of well-preserved or fragmented rock crystals and pieces of quartz and quartzite that may have been intended as raw material for beadmaking. Rarer are the finds of amethyst (2 beads), fluorspar (2 beads) and garnet (5 unworked pieces).

The finds are partly from graves around Kaupang recovered at different times between 1848 and 1974 (Blindheim et al. 1981; Blindheim and Heyerdahl-Larsen 1995). Most of them, however, were recovered during Charlotte Blindheim's investiga-

Cornelian							Other shapes	N=
Blindheim, settlement	2	3	2	1		1		9
Skre, settlement	2	4	1	5		7	1	20
Skre, surface surveys	1		1			1		3
Blindheim etc., graves	5		1	4			1	11
Sum	10	7	5	10		9	2	43
Rock crystal								
Blindheim, settlement	2		4	1		5		12
Skre, settlement	4	2	2	2		14	6	30
Skre, surface surveys		Quarzite 1	1		1			3
Blindheim etc., graves	2		1	3	2	1		9
Sum	8	3	8	6	3	20	6	54

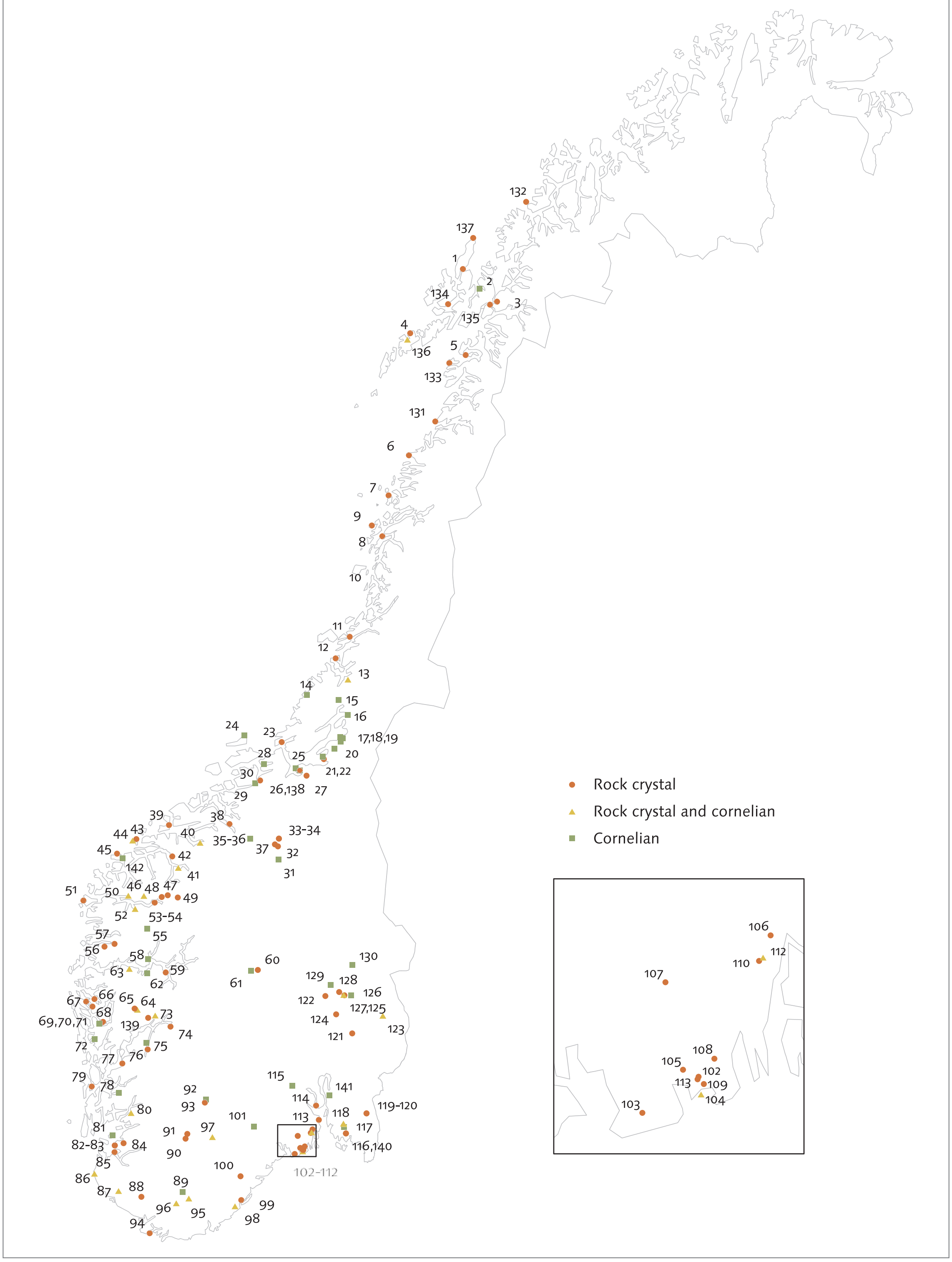
Figure 8.1 *Overview of the objects of cornelian and rock crystal from Kaupang studied: form and category of find.*

Fig 8.2 *The distribution of finds of beads of cornelian and rock crystal from the later Iron Age in Norway (graves, settlements and hoards). This map is a revised version of Resi 1987b:fig. 4, Anm.8 (Findlist 1–130) with the addition of the following finds: 131. Bodø teglverk, Rønvika, Bodin, Nordland (Ts3978); 132. Nordheim, Lenvik, Troms (Ts4052); 133. Hagbartholmen, Steigen, Nordland (Ts5281); 134. Haukenes, Hadsel, Nordland (Ts6362); 135. Stokke, Tjeldsund, Nordland (Ts6387); 136. Borg, Vestvågøy, Nordland (Ts8335); 137. Toften, Andøy, Nordland (Ts10603); 138. Berg, Byneset, Trondheim, Sør-Trøndelag (T5299); 139. Bolstad, Voss, Hordaland (B13953); 140. Hunn, Fredrikstad, Østfold (C37896); 141. Treider vestre, Ås, Akershus (C51434); 142. Osnes, Ulstein, Møre og Romsdal (Å1371). Map, Espen Uleberg, KHM.*

tions of the settlement of 1956–74, and especially through Dagfinn Skre's investigations of the settlement and systematic surface collection of 1998–2003 (Fig. 8.1). The gemstones examined are described in a Catalogue (Appendixes 8.1–5). Fourteen finds of cornelian (12 from graves and 2 from the settlement) and 3 finds of rock crystal (2 from graves and 1 from the settlement) made before 1975 could not be included in this study because the items could not be identified in the museum collection. For a discussion of these, reference must be made to Heyerdahl-Larsen's studies (1979b; 1999).

Polished beads of cornelian have long been regarded as a product of the Far East imported to Scandinavia. This is also the case with some beads of rock crystal shaped to the same forms as the cornelian beads and often found in association with the latter. Rock-crystal beads are found more frequently than cornelian beads in finds of the later Iron Age in Norway. They occur in a wider range of irregular forms, and there is reason to believe that there was some local production as well as importation. The quantity of cornelian and rock-crystal beads from Kaupang, and of rock crystal raw material, provides an opportunity to examine these questions further.

A distribution map of beads of rock crystal and cornelian in Late Iron-age finds from Norway shows how attractive and accessible these objects were throughout the Norse cultural zone (Fig. 8.2). In his work on oriental imports into Viking-period Scandinavia, Ingmar Jansson explained which of the finds of rock crystal, amongst those he listed from Norway, that he considered to be oriental imports rather than either imports from the West or local products (1988:Abb. 10; Fundverzeichnis II, 633–4). At the same time, Ingo Gabriel published his map of the distribution of polished cornelian beads of the 9th and 10th centuries, of centres where the working of beads appears to have taken place, and of areas with concentrations of finds of such beads from the 9th to 12th centuries (1988:Abb. 36, Fundliste 9). Many of the finds in Sweden and Northern Germany contain a remarkably large number of beads. An important background source is Herbert Bach and Sigrid Dušek's catalogue of equivalent finds of rock-crystal and cornelian beads from eastern Europe, through Russia, into India (1971:84–93). Daniel A. Hepp's publication of rock-crystal and cornelian beads from Hedeby and Schleswig provides a map which includes the distribution of finds further



south in central Europe and goes into greater detail concerning find contexts and possible trade routes (2007:Abb.30 and 78–87).

From the current state of knowledge of natural outcrops of cornelian and the easterly distribution of polished cornelian and rock-crystal beads in the Late Iron Age, regions in Iran, India and the Caucasus stand out as possible source areas (von Carnap-Bornheim and Weisgerber 2000; Arrhenius 1976; Näsman 2003:233; Hepp 2007:21–2). Rock crystal occurs naturally over a wider area, including Scandinavia (Arrhenius 1976).

On the basis of a major corpus of Scandinavian finds, Johan Callmer (1977:bead group T) provided evidence that the importation of cornelian beads started late in the 8th century and was extensive, particularly in the second half of the 9th century and the middle and second half of the 10th. A review of cornelian beads in Norwegian grave-assemblages shows that beads of this kind are rare in Early Viking-period finds and that the majority are of the 10th century. They are usually found in small numbers as components of large groups of beads. The tendency is the same with rock-crystal beads. These occur occasionally in graves of the Norwegian Merovingian Period and Early Viking Period but are much more common in the later and very late Viking Period.

8.1 Previous studies of gemstones from Kaupang

Cornelian and rock-crystal beads from the cemeteries associated with Kaupang and from the settlement excavations of 1956–74 were studied by Birgit Heyerdahl-Larsen in two works (1979b, 1999). She adjudged the graves with such beads to be particularly well furnished (1979b:150–2). The majority of them are amongst the boat graves from Bikjholberget, and the majority of the bead graves are dated to the 9th century; a smaller number to the 10th. All the same, she considered it remarkable that only one of these graves (Ka. 127) contained both cornelian and rock-crystal beads. The fact that the same beads also appear in some Norwegian hoards appeared to her to confirm the value of these gemstones. She emphasized the Hoen hoard from Buskerud (5 beads of rock crystal, 2 of agate and 3 of cornelian: C719–51; Steppuhn 2006:216), as well as the hoard from Kroken, Fjære, Aust-Agder (16 beads of cornelian and 50 of rock crystal: C2929).

Heyerdahl-Larsen also addressed the question of whether a cornelian bead from the settlement site that was not fully perforated might indicate that the difficult process of drilling was undertaken at Kaupang itself (1979b:152). She referred to parallels from Birka and Hedeby. This is still an open question: should we believe that foreign artisans produced beads out of imported raw material (cornelian and rock crystal) at Kaupang as Arrhenius has proposed (1978:19–21)? Were unfinished beads accidentally included in loads for sale, as Danielsson has suggested (1973a:71)? Or were the items imported in a semi-manufactured state to Hedeby, and the perforation undertaken by the receiver, as von Müller has proposed (1970:54)?

In the case of the rock-crystal beads, Heyerdahl-Larsen also discussed the possibility of local manufacture at Kaupang. She noted previously ignored settlement investigations in Valldal just west of the western boundary of Telemark. A site where rock crystal was cut was discovered here, and where beads were also polished and drilled. The question was whether raw material could have been transported to Kaupang from these areas. She noted some 25 offcuts and blanks for rock-crystal beads found at Kaupang. However five finds that were referred to as unfinished beads by Blindheim (1969:18) are, as far as the present author can tell, large rock crystals with no certain traces of working.

In the chapter on the working and provenance of beads, Heyerdahl-Larsen (1999:65) picks out another bead from the settlement with a half-drilled perforation; in this case, one of rock crystal. She emphasized that it was the spherical rock-crystal beads that she regarded as possible local products while the faceted types were probably imported from afar. Amongst the cornelian beads from the settlement excavations she refers (1999:66) to the specimen noted above with an unfinished perforation that was broken while being drilled. The absence of cornelian as raw material is highlighted. Heyerdahl-Larsen interprets these beads as unfinished or defective objects that were accidentally included in large consignments of goods.

Figure 8.3 *Cornelian beads from Kaupang.* ***a:*** *Spherical bead; pit by the drilled hole on one side, C52519/24591, Cat. 8.1:7;* ***b:*** *spherical bead with patches of colour like agate and dark freckles; settlement find from Kaupang, C52516/3858, Cat. 8.1:8;* ***c:*** *faceted discoid, round bead; white (scorched); offcut at one end of the drilled perforation; settlement find from Kaupang (Blindheim), Cat. 8.1:10;* ***d:*** *faceted discoid, round bead of regular form, translucent; settlement find from Kaupang (Blindheim), Cat. 8.1:11;* ***e:*** *faceted spherical bead of regular form; sides polished in various planes; colour, translucency and the absence of inclusions represent cornelian of high quality; settlement find from Kaupang, C52519/11585, Cat. 8.1:19;* ***f:*** *faceted polyhedrical bead with deep polishing grooves on some sides; marred by iron oxide inclusions; drilled hole from two sides which does not join up; settlement find from Kaupang, C52519/10094, Cat. 8.1:26;* ***g:*** *faceted prismatic bead of regular form; evidence of two stages of polishing, first coarser, then finer, and attempts to remove inclusions close to the surface; grave find from Kaupang, Ka. 286, Cat. 8.1:34. (Scale 2:1). Photos, Lill-Ann Chepstow-Lusty, KHM.*

8.2 The material

This study focuses primarily upon the finds from the settlement investigations of 1998–2003 directed by Dagfinn Skre and the available material from the settlement investigations of 1956–74 directed by Charlotte Blindheim. Only a small selection of stone beads from graves have been included as comparative finds. The beads are classified according to Johan Callmer's typology (1977:Groups T and S). Identifications of colour follow Munsell (1929).

The measurements and assessment of the stones and working by gemmologist Brenda Jensen are an essential element of the catalogue and they form the basis for the assessment of the Kaupang gemstones in this chapter. Crystallinity is measured by means of a polariscope and the refractive index with a refractometer in so far as the polished faces allowed for this. The gemmologist's evaluation of the quality of the raw material and the stonework-ing is included, even though criteria of quality may have changed from the age of Kaupang to our own. A summary of the evidence is provided in the catalogue in Appendices 8.1–5.

8.2.1 Cornelian

One stone for mounting and 31 beads of cornelian

a b d e f

c g

were recorded amongst the settlement finds. The beads are in five different forms: spherical (9: Fig. 8.3a–b); faceted discoid (7: Fig. 8.3c–d); faceted spherical (4: Fig. 8.3e); faceted polyhedrical (6: Fig. 8.3f); and faceted prismatic (5: Fig. 8.3g). Two-thirds of the beads are of very regular shape. A few that are classified as irregular or which have an uneven surface are rounded or spherical.

Cornelian is considered quite easy to identify: it is translucent, red or orangey-red, slightly less hard than quartz (7). In identifying the material, the refractive index (RI) of the majority of the measurable beads proved to be 1.54 or occasionally 1.53. Through the polariscope some specimens were identified as crypto-crystalline (9), others as polycrystalline (8). Translucency was recorded (13).

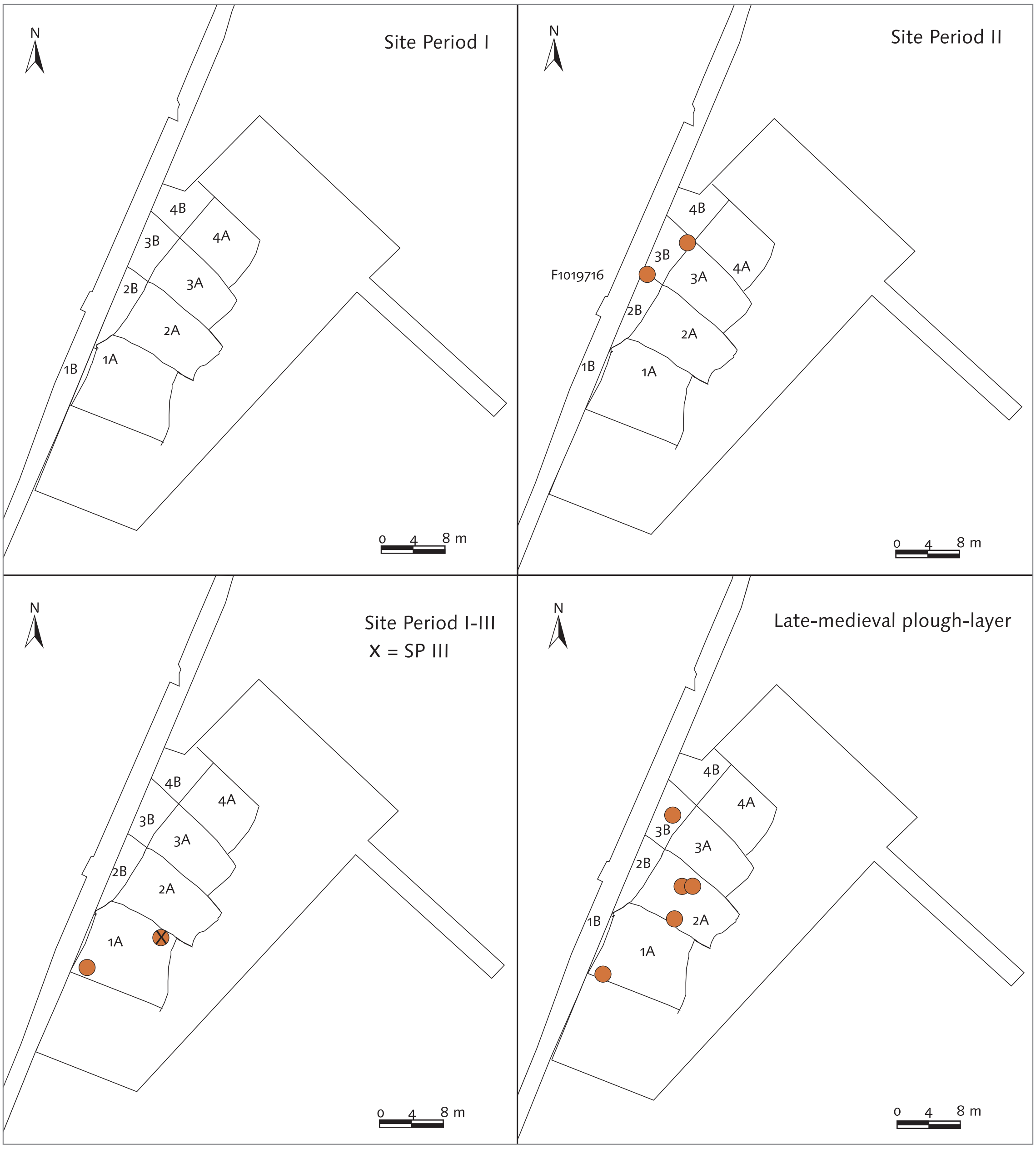
Colour identification of the beads analysed shows that the great majority are red, a few are light red and four dark red. Several of the beads have varying tones of red (colour zoning: Fig. 8.3b). Five beads are scorched. These have a chalk-white surface (Fig. 8.3c), as happens with quartz at a temperature of about 600°C. On one bead (Cat. 8.1:21) the gemmologist noticed evidence of the use of heat to improve the colour to dark red. This bead was not fully perforated. It may have been intended to have been used and fastened in some way other than as a bead.

Two stages of polishing have been observed: coarse lines in one direction and finer lines over the top of them and in another direction. One can also see that attempts have been made to remove dark inclusions that reach the surface (Fig. 8.3f–g).

The majority of the drilled holes in the cornelian beads (18) were drilled from two sides although four beads appear to have been drilled from just one side (Cat. 8.1:2, 3, 4 and 9). Straight drilled holes, however, need not mean that the perforation was only drilled from one side. In cases where the drilled holes barely meet, traces of drilling with a narrow drill to link the holes have been recorded (Cat. 8.1:23). The diameters of the drilled holes are 0.7–2.8 mm. In many cases the diameter varies in a single drilled hole, a phenomenon that Hepp has interpreted as a result of the use of a drilling stick that rotates in a circle around its own axis (2007:69, Abb. 27). The beads sometime have visible grooves running around the inside of the drilled hole (Cat. 8.1:30 and 31). These may have been caused by hard particles freed during drilling which followed the drill around in the hole. Hepp (2007:69 and refs.) suggests that an abrasive attached to the metal drill could produce such grooving.

On a number of beads there was a pit or hollow beside one (Cat. 8.1:1, 3, 4, 7, 8 and 27) or both (Cat. 8.1:2 and 9) of the mouths of the drilled hole. Some of these pits are clearly the products of attempts to remove disfiguring inclusions (Fig. 8.3g) but others require a different explanation, although it is unclear what. They may have been made in order to mark where the drilling should start, and to help direct the drill correctly. They may have been produced during drilling, or have been made at the end to even out the mouth of the drilled hole where the side may have shattered and flakes come off leaving sharp edges. It has not been possible to determine the sequence of drilled hole, pit and polishing of uneven surfaces. Cornelian beads have repeatedly split at the drilled hole (Cat. 8.1:15, 17, 25, 28, 29, 30 and 31). On one occasion, the drill went into a geode, a small cavity whose sides are covered with crystals (Cat. 8.1:29). This may have caused the bead to split, when the drill hit a crystal.

A total of three cornelian beads on which the drilled holes fail to meet have been recorded. One of these is faceted spherical, two faceted polyhedri-



cal (Cat. 8.1:17, 21 and 26; Fig. 8.3f). Various possible explanations were noted under the account of Heyerdahl-Larsen's studies above. None of the finds of cornelian can be identified with certainty as raw material or a semi-manufactured item. It is possible that the damaged goods arrived with consignments from overseas, or that beads which were partially drilled were meant for use and suspension in some other way. We have no evidence that any polishing was undertaken at Kaupang, and although no definite drills have been found there, and there are no suitable implements of copper alloy, drilling could nevertheless have taken place there. The iron artefacts from the settlement investigations of 1956–74, however, included 31 rods of diameters matching the drilled holes in the beads.

General assessment

From Kaupang, a total of 57 finds of cornelian are known, of which 43 have been included in the present study. These 43 cornelian objects are mostly of familiar forms (Fig. 8.1). Amongst the cornelian finds from Skre's work, however, there are two unusual forms: a round and flat bead like Callmer (2007) T005 which has facets between the face and the circumference (Cat. 8.1:15) and an oval stone for mounting (cabochon) which has an agate-like pattern on the upper face (Cat. 8.1:32).

The assessment of the quality of the cornelian objects according to depth and consistency of colour, translucency, absence of inclusions, and quality of polishing, shows that the majority of the finds of cornelian from Kaupang are of high quality.

Figure 8.4 *Spatial distribution of cornelian beads. Map, Elise Naumann.*

Figure 8.5 *Rock-crystal beads from Kaupang.* ***a:*** *Spherical bead; evenly polished, translucent; re-polished, flat surfaces on either side by the mouths of the hole; settlement find, C52519/18617, Cat. 8.2:19;* ***b:*** *faceted discoid, round bead; translucent; well polished on the side and the edge but matt on the rim; drilled from two sides — a successful attempt has been made to join up the drilled hole with a drill of diameter under 1.2 mm; settlement find, C52519/16467, Cat. 8.2:28;* ***c:*** *faceted discoid, round bead; many white inclusions; drilled from two sides — the holes are joined by a very narrow drilled hole whose diameter is shown by the thread (diam. 0.13 mm) in the picture, C52264/12, Cat. 8.2:29;* ***d:*** *faceted spherical bead, most similar to Callmer 1977:T010; wear on the faceted surfaces; settlement find (Blindheim: 1962 D Kat. a–g), Cat. 8.2:35;* ***e:*** *faceted polyhedrical bead of regular shape; translucent; polished in several directions, first with a coarse abrasive and then with finer abrasives; a little wear on the bead; settlement find, C52519/11098, Cat. 8.2:40;* ***f:*** *spherical bead of quartz; flattened at the mouth of the drilled hole on either side; grave find, Ka. 299, Cat. 8.2:47;* ***g:*** *prismatic, faceted bead; wear on the faceted surfaces; signs of two stages of polishing; grave find, Ka. 299, Cat. 8.2:49;* ***h:*** *two faceted biconical beads from grave Ka. 265; one (the upper) of the same form as Callmer 1977:S014, the other (lower) differs from this model in that the facets with pointed terminals are plaited together in turn in the central zone; Cat. 8.2:50–51. (Scale: 2:1). Photos, Lill-Ann Chepstow-Lusty (a–b and d–h), and Maryam Babashahi (c), KHM.*

The cornelian finds from the settlement area made from 1956 to 1974 were relatively evenly spread across the area of excavation (Heyerdahl-Larsen 1979b:153, fig. 3). This is also the case with the finds from 1998 to 2003 (Fig. 8.4). Cornelian is represented in stratified layers from SP II onwards. It was therefore present at Kaupang from the early 9th century.

8.2.2 Rock crystal

A bead is rock crystal if it has been formed from a single crystal of quartz, it is quartzite if it has been made from a rock consisting of many quartz grains cemented together. Most of the beads are made of true rock crystal but there are five of quartzite. We have chosen to use the term "rock crystal" for all of these.

When the stone is transparent and the surface is not "frosted" it is easy to distinguish a rock crystal from quartzite or glass by means of a polariscope. As long as a surface is plane and has suitable polishing it is also possible to read the refractive index. A lens used in conjunction with the polariscope can find the interference figure that is typical of quartz a

crystals (cf. terminology in Appendix 8.2). The criteria of quality for rock crystals are size, clarity and the density of inclusions. By these criteria, the finds vary widely.

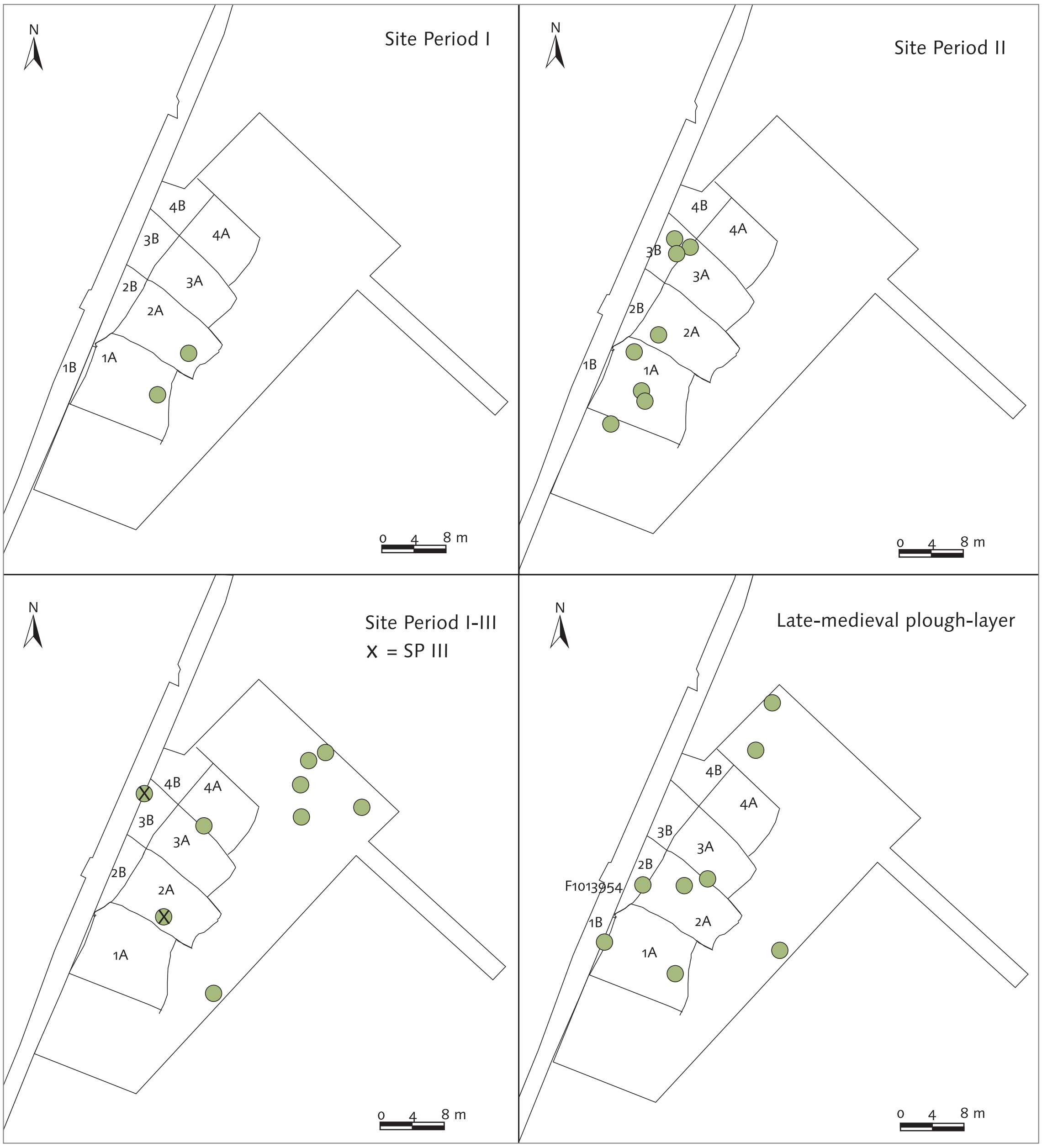
Forty-six beads of rock crystal were recorded as settlement finds. Around half of the rock-crystal beads are spherical (21: Fig. 8.5a) while the remainder are evenly divided amongst six different forms: almost barrel-shaped (5:Fig. 8.5f); faceted discoid (3: Fig. 8.5b–c); faceted spherical (7: Fig. 8.5d); faceted polyhedrical (4: Fig. 8.5e), faceted prismatic (5: Fig. 8.5g); and faceted biconical (1: Fig. 8.5h). Most of the beads are very regular in shape, while only a small number can be described as irregular or having an uneven surface.

Like their cornelian counterparts, the faceted discoid beads all have a "belt": a narrow surface on the rim that is unpolished. This is not found in Callmer's survey (1977). One of the large rock-crystal beads from a grave has a slightly different biconical form than that reproduced in Callmer's study (Fig. 8.5h, lower).

Well-polished rock-crystal beads have been polished at least twice, as noted above with cornelian. In some cases, however, it is possible to detect three stages of polishing. Three different types of abrasive may have been used. It is possible that the surfaces

Figure 8.6 *Pp. 150–1: Spatial distribution of* ***a:*** *rock-crystal beads;* ***b:*** *raw material of rock crystal. Map, Elise Naumann.*

b



were filed with three different whetstones. Signs of the first coarse polishing have been observed on small beads of low-quality material and on facets where the drilled hole is located.

The drilled holes are mostly drilled from two sides (18), although with a higher proportion than in the case of the cornelian beads, drilling seems to have been undertaken from just one side (14). In more cases than with the cornelian beads it was also possible to see that two opposite drilled holes on a bead are linked by a much narrower hole. In one case the linking hole is so narrow that it is difficult to imagine what sort of cord the bead could have been strung upon (Fig. 8.5c). Visible grooves running around the drilled hole, produced by drilling, were seen in one case (Cat. 8.2:34).

As with the cornelian beads, there are several cases where there is a pit or hollow on one (Cat. 8.2:4, 5, 8, 12, 14, 17 and 23) or both (Cat. 8.2:6, 9, 15, 19, 20, 22, 25, 27 and 39) sides of the drilled hole. The pits by the drilled holes can be re-polished. In one case these are polished, small, plane surfaces (Cat. 8.2:19; Fig. 8.5a). Attempts were also made to remove unsightly inclusions close to the surface.

In some cases the signs of working allow one to reconstruct the sequence of work, as on a faceted, spherical bead that was coarsely polished, then drilled, then more finely polished (Cat. 8.2:34). We have no example of rock-crystal beads lacking the drilled hole. On one broken quartzite bead, however, the drilling seems to have been stopped when the drill hit a dark mineral (Cat. 8.2:3). The quartzite beads are often damaged. The fracture surfaces follow grain boundaries.

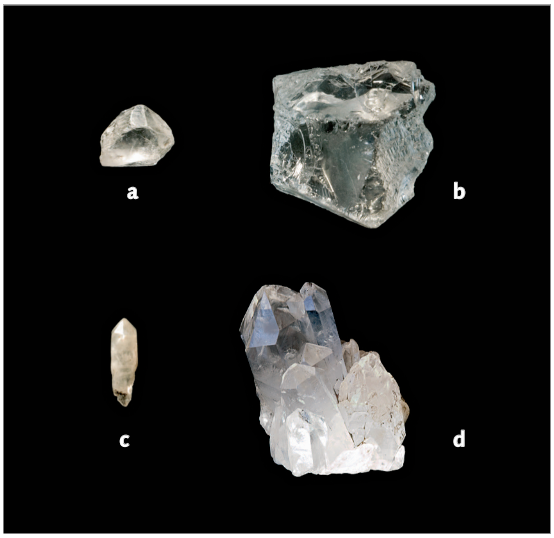


Fig. 8.7 *Rock crystal as possible raw material.* ***a:*** *The top of a quartz crystal; possible remnant of a crystal used as raw material; settlement find, C52519/2629;* ***b:*** *a large, double-split quartz flake from a large crystal; fresh break surfaces with very thin sides – waste from jewellery making? Settlement find, C52519/9740;* ***c:*** *small rock crystal from the settlement area, C52519/3446/2;* ***d:*** *group of rock crystals from the settlement area, Blindheim: CP K 1970. (Scale 1:1). Photos, Lill-Ann Chepstow-Lusty, KHM.*

Figure 8.8 *Spatial distribution of the amethyst beads and garnet crystals. Map, Elise Naumann.*

The rock-crystal beads from the excavations of 1956–74 were widely spread across the areas excavated (Heyerdahl-Larsen 1979b:153, fig. 3). The rock-crystal beads from the excavations of 1998–2003 were also relatively widely spread, although only a few can be assigned to datable layers (Fig. 8.6a). There is one bead from SP III and another of SP I–III. The former was found in or east of Plot 1A, the latter in Plot 2a–b and east of it. In the layers of the MRE there are, then, no rock-crystal beads earlier than SP III, which means in the second half of the 9th century. However possible raw material of rock crystal for making jewellery or some other objects is found in all layers and is widely distributed across the areas of excavation (Fig. 8.6b).

Rock crystal, quartz and quartzite as possible raw material

The raw material can be classified in the following three categories:

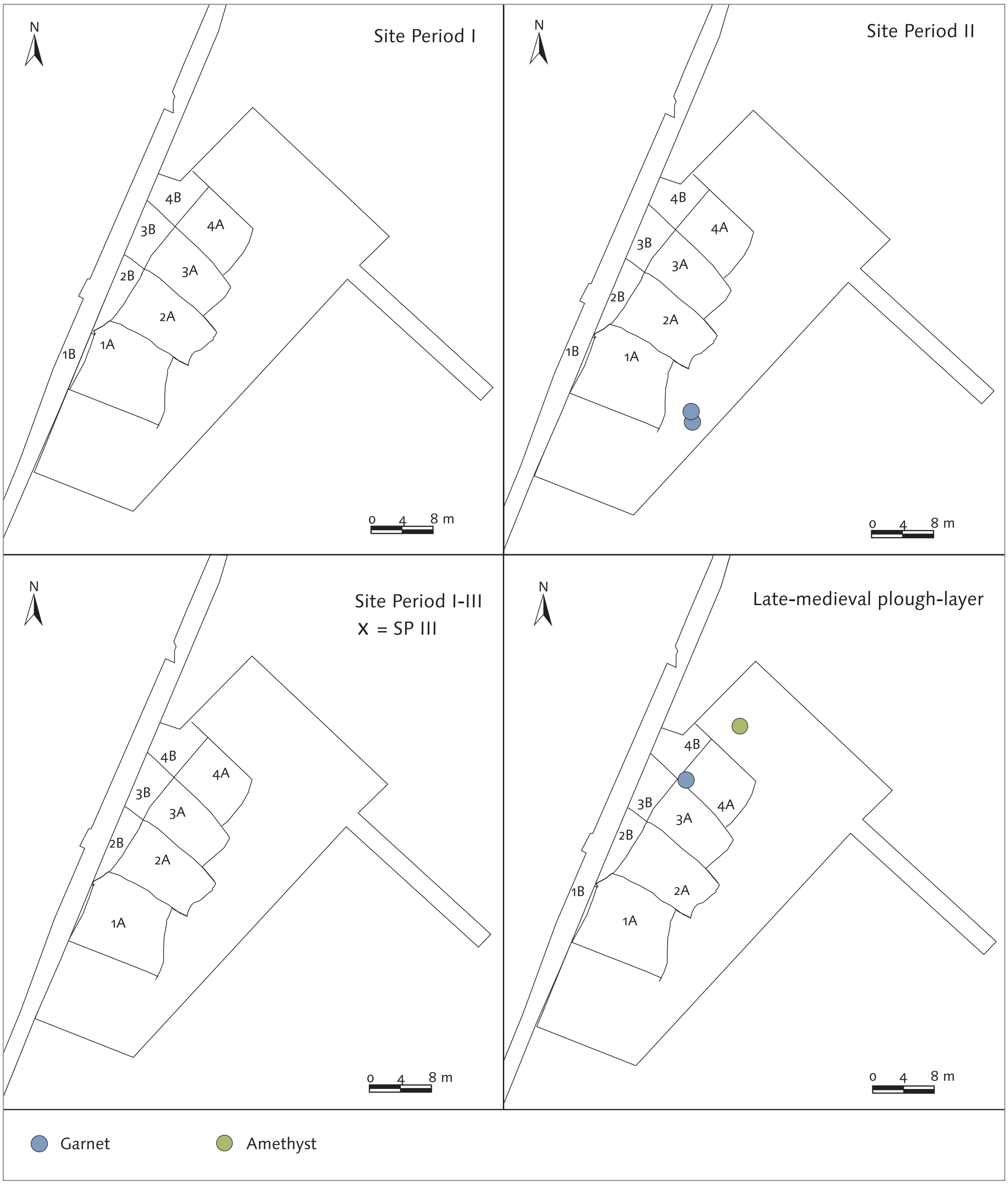
Large crystals (10 mm or more): consist of a six sided (hexagonal) prism topped by a pyramid of six triangular faces. Sometimes only the top survives (Fig. 8.7a), and the remainder may have been used to make something. Some of the crystals are as clear as glass (Fig. 8.7b) while others are scratched and milky and not obviously usable. Examples of smoky quartz crystal (grey-brown) are also present. There is one large fragment of a clear rock crystal with two natural crystalline surfaces. We conclude that this implies that the residents of Kaupang took care of rock crystals. Working in the form of cutting seems also to have been practised, but it is not certain what was being produced. There is no clear evidence that polishing or drilling of rock crystal was undertaken at Kaupang.

Small, thin crystals (Fig. 8.7c–d): there is a significant number of these (5 mm long; 1–2 mm wide). They are of the usual crystalline shape and usually in very fine condition, with mirror-like surfaces and knife-sharp edges. There is often evidence that these crystallized in a straight group of crystals, amongst which growth was sometimes affected by neighbouring crystals. The sharp edges show that these cannot have been borne for long by water or ice. It is probable that these crystals were collected from natural outcrops where large cavities in rocks were filled with quartz crystals. These small crystals may simply have arrived with a lump of crystal that was imported to Kaupang, where they were broken off and discarded.

Water-rolled material: there is a little water-rolled quartz, but a higher proportion of the quartzite is in pebble form. One can only speculate that the raw material may have been supplemented with finds from river gravel. This was not a very effective strategy as the quartzite is often crazed and splits along the grain. Amethyst and fluorspar pebbles were also used as raw material for beads (see below).

The manufacture of rock-crystal beads at Kaupang?

The large piece of high-quality quartz (Fig. 8.7b) means that large beads may have been manufactured at Kaupang. Many have assumed that complicated polished rock-crystal beads of the same forms and sizes as found with cornelian beads should be counted as imports from the Far East. Amongst the 54 rock-crystal beads from Kaupang, just over half (28) are of these forms, while the remaining spherical or less regular shapes (26) may well include some local products. In his article on the production of rock-crystal beads on the Suldal and Røldal heaths in the Late Iron Age, Bjørn Myhre (2005) described certain types of semi-manufacture and working techniques that are represented at these special find places. At Finnabu, these include struck, roundish cores with crushed sides, a round-oval piece of rock crystal with a drilled hole, unworked crystals, and quartzite smoothing stones. The work at Valldal is described thus:



After the crystals were divided up into the correct shape and size through chopping and finer retouching, they were further rounded by small, light blows on uneven points. Then the actual process of smoothing began, using quartize stones, as represented at the work-site at Valldalseter. (Myhre 2005:84, trans.)

Amongst the raw material of rock crystal, quartz and quartzite from Kaupang, there are not only individual struck and rounded cores but also a large quantity of unworked crystals. Many of the crystals, however, are so small that it makes more sense to interpret them as discards after the selection of larger, more usable pieces. A large number of sharp-edged quartz flakes which were found during the settlement excavations of 1998–2003 may, however, be offcuts from jewellery making. Amongst the whetstones there is also one of white quartzite, which is thus a parallel to the finds from Valldal. On the other hand, no drilled holes or polished surfaces on unfinished rock-crystal blanks have been recorded at Kaupang. It is clear, then, that rock crystal was brought to Kaupang and struck there, but it is not certain that this was for beadmaking.

8.2.3 Amethyst

The two amethyst beads were found during the excavations of 1998–2003 (Cat. 8.3). Amethyst is a violet quartz which can range in colour from light lilac to deep purple. This is not a common min-

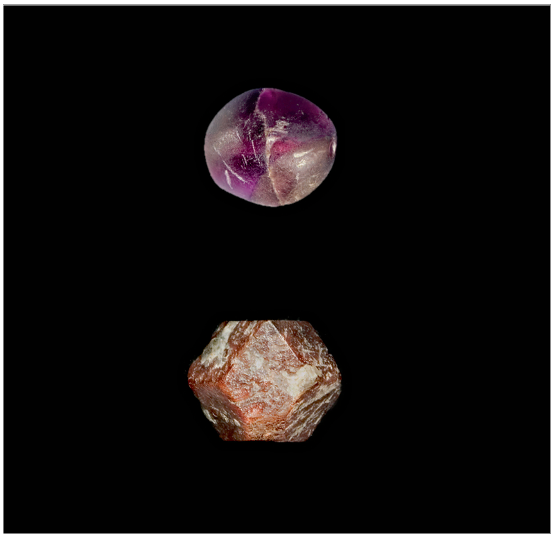


Fig. 8.9 *Almost oval bead of fluorspar. Water-rolled material (pebble). Settlement find from Kaupang, C52519/16466, Cat. 8.4:1. (Scale 2:1). Photo, Lill-Ann Chepstow-Lusty, KHM.*

Figure 8.10 *Crystal of garnet. Dodecahedrical rhomboids (12 rhomboidal surfaces). Almandine. Settlement find from Kaupang, C52519/10307, Cat. 8.5:2. (Scale 2:1). Photo, Lill-Ann Chepstow-Lusty, KHM.*

eral in Europe or Asia. Purple fluorspar is the most important "lookalike", as this is quite common in Scandinavia.

The two pieces of amethyst are of poor quality. Both have been drilled. One is clearly a pebble of oval shape which has had its sides rounded and the surface "frosted" through constant impact against other stones (Cat. 8.3:1). It is colourless apart from one band of a strong purple colour. The other is of an irregular, almost oval, shape, well polished, and with a very pale lilac hue (Cat. 8.3:2). Comparable amethyst beads are known from Helgö, Eketorp and Birka (Arrhenius 1978:13). These two beads were both found in the plough-layer, one in the area north of Plot 4A (Fig. 8.8). The stratigraphy thus does not date the beads any more closely than to c. AD 800–950.

8.2.4 Fluorspar

The two pieces of fluorspar in the finds assemblage are pebbles that were drilled or had been attempted to be drilled (Fig. 8.9; Cat. 8.4:1–2). They are both of a very strong purple hue with some variation in coloration. The colour is dark, appearing almost black. This material is of low hardness and breaks easily. Both pieces of fluorspar, like one of the amethysts, are pebbles. This may indicate some local exploitation of stones found in river gravel. The contexts of the finds provide no closer dating of this bead-type than to c. AD 800–950.

8.2.5 Garnet

There are five quite similar pieces of garnet from Kaupang (Fig. 8.10; Cat. 8.5). These are all unworked crystals. Garnets have a strong tendency to form regular crystals even when they grow in solid bedrock. They can have one of two shapes: rhombic dodecahedron (with 12 rhomboidal surfaces) or trapezohedron (24 surfaces). All of the crystals from Kaupang are rhombic dodecahedra. One has grown slightly lopsidedly so that its cubic symmetry is not evident, although its form is quite recognizable (Cat. 8.5:3). The crystals are nearly black, but under strong light it is possible to see that they glow red inside. The dark coloration points to the iron-rich end of the spectrum (almandine) and it proved possible to read an almandine spectrum from the side of one of the crystals in confirmation of this. No attempt has been made to smooth, polish or drill these crystals.

Almandine forms in metamorphic rocks and the crystals are often left behind when the rock disintegrates. Material of this kind can be found in many places in the pre-Cambrian bedrock of Norway and Sweden and that is the probable source. The crystals look too dark, too opaque, too small, and too broken to have been of use in jewellery. The question is, then, what value did they have and how were they used in Kaupang? Unworked garnets have been found in archaeological excavations of later sites in Sweden and are speculatively interpreted either as raw material for jewellery or as an abrasive (Lundström 1973; Löfgren 1973; Arrhenius 1985, 1997; Lundquist 1996). The garnets from Kaupang may be used as an abrasive in the extensive craftworking that was going on in the town.

Two of the garnets can be associated with SP II (Fig. 8.8). These were found in the midden east of Plot 1A. They can be dated to the first half of the 9th century. The others are from plough-layers and cannot be dated any closer than to c. AD 800–950.

8.3 Comparative perspective

Cornelian and rock-crystal beads have been found at numerous sites of the Late Iron Age in Norway (Fig. 8.2), as elsewhere in Scandinavia and in central and eastern Europe (Hepp 2007:77, Abb. 30). Most of the points on the distribution maps, however, represent sites with only a few beads. As long-distance traded goods these gemstones are of interest from several perspectives. Here it is most relevant to concentrate upon the parallels to the gemstones at Kaupang from trading sites with the same sphere of contacts. Unfortunately there are few full-length studies of the gems from these sites.

Objects of cornelian and rock crystal from various campaigns at Birka have been published in a variety of contexts. The most comprehensive discussion of the topic was provided by Kristina Danielsson in her assessment of the finds from the excavations in the Black Earth of the harbour area from 1970–71 (1973a). With reference to about a thousand rock-crystal and cornelian beads from 109 graves at Birka and some hundreds from earlier work in the Black Earth, Danielsson analysed 47 cornelian beads and 73 rock-crystal beads from the harbour area. She also notes a bee-shaped cornelian pendant amongst the finds, now thought to be cornelian (pers. comm. B. Ambrosiani).

Ingmar Jansson subsequently noted two further examples, one from Birka and one from Västmanland, which he connects with lapis lazuli pendants of the same shape found between the Dniepr and western Siberia (1988:588). An oval, polished, cornelian stone for mounting which also has a parallel in grave 791 at Birka is amongst the finds from the harbour area. Danielsson attached importance to the number of round beads compared with the various faceted shapes in both collections (11 out of 47 cornelian beads; 21 of 73 rock-crystal beads), and showed that the faceted beads of rock crystal were rather more frequent in the lower (earlier) strata than round beads but not amongst the cornelian beads. It is plausible that local Scandinavian production of round rock-crystal beads may be the explanation.

Amongst the finds from the harbour there are 4 cornelian beads and 3 rock-crystal beads that are undrilled, while 25 further finds are noted from earlier work in the Black Earth. Danielsson discussed various explanations of this situation. She considered it possible that finely polished beads of cornelian and rock crystal may have served as items of value and so suggested that drilling (or its absence) would not matter if that were the case. She noted several silver hoards that also included such beads (1973a:70–1). In a presentation of the beads from the more recent excavations in the Black Earth in 1990, Björn Ambrosiani (1995) referred to a total of 65 beads, 42 of rock crystal and 23 of cornelian, of which 38 are faceted, 23 round and 4 of other shapes.

From excavations at the Viking-period wharf and trading and craft-production site of Paviken on Gotland, there are 277 garnet crystals and one garnet with signs of working. The majority of these, including the specimen with evidence of polishing, were found in a concentrated area of some 20 sq m which is interpreted as a workshop area or store place (Lundström 1981:90–1). There is also an irregularly polished rock-crystal bead from Paviken, and three unworked pieces each of rock crystal and cornelian. On the basis of petrographical analyses, the garnets were apparently sourced from western Sweden, probably Halland (Löfgren 1973). Agneta Lundström linked the garnets from Paviken to local finds of Vendel-period jewellery ornamented with garnets, and pointed out that garnets and moulds for such jewellery had been found on Helgö (1973:75; Arrhenius 1971:48, 58, fig. 53a–c). Birgit Arrhenius emphasized elsewhere what a common mineral garnet is in Sweden, and that its worth as an abrasive should not be underestimated (1997:39–40).

Amongst the 109 garnets that were subsequently found during the excavations of the Iron-age farmstead of Slöinge in Halland only one was worked and the others were in a raw state. Lars Lundqvist interpreted these garnets functionally as being meant for jewellery or as abrasives (1996:20). The garnets were found scattered over the area of excavation, but are noted particularly in two post-holes that were full of finds in Buildings II and III (Lundqvist 1996:13, Tab. I). Birgit Arrhenius has noted that the worked garnet from Slöinge shows marks of an engraving point (1997:43, fig. 2). The presence of garnets in the post-holes is considered to be connected to the idea that they had some magical properties and a special value, and could confer prosperity without being mounted.

From Ribe, precious stones are represented by a total of 39 finds from the excavations on the northern side of the Ribe River, 1984–2000 (Feveile 2006). These are from sites ASR 9 Posthuset, ASR1085 Gasværkgrunden and ASR 1357 Giörtvej. The largest collection is from ASR 9 Posthuset (21), comprising cornelian, rock-crystal and amethyst beads, Roman gemstones, and some as yet unidentified forms of stone (Feveile and Jensen 2006:138). From ASR 1357 Giörtvej beads and raw material of rock crystal, garnet crystal, and amethyst and cornelian beads have been illustrated (Feveile 2006:393, tav. 13.2–6). Overviews have reproduced beads of cornelian and amethyst and raw material of rock crystal and quartz (Bencard 1978:125) as well as rock-crystal beads and garnet crystal (Jensen 1991). The proportions of the different materials and forms are not given. Since it is precisely the find-spot at ASR 9 Posthuset that, according to Claus Feveile and Stig Jensen (2000), supports a narrower dating of eight contexts between c. AD 705 and 850, there is reason to look forward very positively to a publication of the precious stones from this site.

Three different published studies have discussed the gemstones from Hedeby. Adrian von Müller (1970) analysed 10 cornelian beads with secure contexts from the area of excavation of 1963–4. He grouped these in terms of six different shapes. With one exception the working of the objects and their material were adjudged to be of averagely good quality. Very fine drills had been used to perforate the beads, the most difficult stage of the work. In one case he could show that the drilled hole was narrower in the centre of a bead. No unworked cornelian was found but there were fragments of beads that had broken while being drilled. From this he concluded that there had at least been some working of semi-manufactures within the trading site.

In her study, Birgit Arrhenius (1978) first considered a gold-framed amethyst pendant discovered during systematic fieldwalking within the semi-circular rampart at Hedeby. The frame was made of gold foil, spun gold wire and filigree, and appears (falsely) to be plaited. The wire was drawn. This technique is called "loop stitch" (*Ösenstich*). The amethyst is imprecisely semi-polished, and a perforation shows that it was originally a bead. Amethyst was especially common in Scandinavia from c. AD 550 to 700 in the form of drop-shaped beads; less common in the 8th century. Amethyst beads are still not uncommon in the Viking Period. Examples from Helgö, Eketorp and Birka are noted. Arrhenius saw evidence that it was not only finished stone beads that were imported but that oriental gem-cutters had also been resident in Birka.Some of the stone beads of the Viking Period may have been manufactured in Scandinavia. This was the case in the later 9th century, contemporary with the flourishing of Carolingian rock-crystal art.

In a larger scale work, Daniel A. Hepp (2007) has considered all the finds of rock-crystal and cornelian beads from Hedeby and Schleswig. This comprises 228 rock-crystal beads and 198 cornelian beads from Hedeby and two of each category from Schleswig. The work is thematically wide-ranging: from the study of the extant bead-forms to information on the process of production, questions of raw material, cutting, smoothing technique, drilling and polishing, the interpretation of semi-manufactures and failed goods, to the role of Hedeby as a trading and production site with regard to beads of gemstone. A catalogue contains information on form, size, material, condition and evidence of working and use, and all of the beads have been drawn.

It is stressed that the cornelian beads from Hedeby are usually of higher quality than the rock-crystal beads. There is no cornelian as raw material. A mere few, uncertain flakes of quartz are discussed as possible blanks of rock crystal. If there was any manufacture of beads of precious stone in Hedeby, Hepp suggests that itinerant craftsmen may have brought semi-manufactured goods with them that were completed on the site. Forty unfinished beads constitute 12.7% of all the finds. These are beads with incomplete perforation or, less frequently, unpolished beads – a dubious criterion. Cornelian beads are more frequent than rock-crystal amongst the semi-manufactures and failures.

Beads of cornelian and rock crystal were found primarily in layers II–IV in the settlement area which are dated to the 9th and 10th centuries, primarily on the basis of finds of imported pottery. The distribution of the beads in layers I–VII shows, however, that they occurred throughout the 9th and 10th centuries. Cornelian beads are more frequent in the upper layers than rock-crystal beads, which argues against the idea of the independent Scandinavian production of rock-crystal beads in the latest phase (Hepp 2007:87). Referring to a study of grave finds from Hedeby (Arents 1992), Hepp shows that the fashion of strings of beads containing cornelian and rock crystal emerged in the second half of the 9th century and continued into the first half of the 10th, with a peak around AD 900. Hepp interprets the occurrence of rock-crystal and cornelian beads in relatively richly furnished graves as a sign that these were luxury items used by an elevated social class. At the same time he lays stress upon the occurrence of these beads in Scandinavian and Slavonic trading centres and in Slavonic strongholds of the 9th–10th centuries as evidence of their active connexion to the rich oriental trade.

The worked finds of gemstones from Kaupang are not a large assemblage compared with their counterparts from Birka and Hedeby. They do represent, however, a rich variety of bead-forms. There is also one oval stone for mounting of cornelian. It is appropriate to note the dating of rock-crystal and cornelian beads in graves at Birka throughout the 9th and 10th centuries (Arrhenius 1978:Diag. 1) and their importation to Hedeby in the same period. Burials at Kaupang from the same period also contain beads of cornelian and rock crystal. The discovery of an oval stone for mounting of cornelian from the Black Earth at Birka, and another from a grave at Birka, may provide parallels to the stone for mounting from Kaupang.

The very large amount of garnet crystals from Paviken and Slöinge – and also those at Ribe – enables us to consider the finds from Kaupang as essential and predictable material for polishing in various craft contexts. Finds of rock crystal as a raw material at Paviken, and of both rock crystal and quartz of this kind from Ribe, should, however, be compared both qualitatively and quantitatively with equivalent finds from Kaupang.

To date, the cornelian found as raw material at Paviken is unique. Birgit Arrhenius's comments (1978) on how difficult it can be to identify raw cornelian, and on how much cornelian beads may be coloured, are of interest in this connexion. One of the cornelian beads from Kaupang shows possible signs of having been coloured by heating (Cat. 8.1:22).

Von Müller and Hepp's assessment of the cornelian objects from Hedeby as finds of quality agrees nicely with that above concerning the cornelian beads from Kaupang. If von Müller's observation of narrower drilled perforations in the centre of cornelian beads is understood correctly, this confirms what was noted also on seven of the rock-crystal beads and one cornelian bead from Kaupang.

There is still uncertainty about the exact sources of cornelian and rock-crystal beads of the Viking Period found in Scandinavia. In the case of cornelian, India, the Near East and the Caucasus have been suggested; for rock crystal, India and Scandinavia (Hepp 2007:78–81).

Herbert Jankuhn was the first to interpret the finds of cornelian and rock-crystal beads from Hedeby as probable imports from the Far East, identifying on the map important supply-routes to Scandinavia along the Dniepr and Volga Rivers (1943; 1986:Plan III). His outline maps are still used in scholarly literature (Hepp 2007:79, Abb. 31). The S.–N. route from Byzantium through Kiev towards Staraja Ladoga followed the course of the Dniepr for large stretches, while the SE.–NW. route from the Caspian Sea through Bolgar to Staraja Ladoga followed the Volga. The Dniepr route is corroborated, according to Ingo Gabriel (1988:196–7, Abb. 36), by the concentration of finds of semi-polished cornelian beads in the territory of the Kievan Rus'. In the case of both routes, the embarkation of cargoes to be taken by ship from Staraja Ladoga to possible distribution points in Scandinavia such as Birka and Hedeby is postulated.

In his work on Viking-period long-distance trade in northern Europe, Søren M. Sindbæk (2005) stresses the significance of features at the major trading sites that made them nodes of long-distance exchange. Here there are found imported goods, means of exchange, and the presence of crafts that required the supply of raw materials from distant lands. A combination of waste and imported raw materials characterizes the finds assemblage much more than finished imported goods and means of exchange. Long-distance transport linked areas that were not in immediate juxtaposition to one another. The terms "route" and "node" are foregrounded as being of importance. "Regularized long-distance exchange constitutes *routes* and its extent defines the significance of the site as a *node*" (Sindbæk 2005:106).

Referring to a Swedish research project, "the forcing of the route Sigtuna–Novgorod with a Viking-style ship", led by maritime archaeologist Rune Edberg in 1996, Sindbæk emphasizes the evident difficulties of long-distance transport by boat along the Russian rivers mentioned. The discussion of possible combinations of transport both winter and summer reveals instructive clusters of problems.

From Sweden in particular, but also from much of the rest of Scandinavia, a wide range of Viking-period finds are known that either come from the Orient or are of oriental style. The most numerous are Islamic silver coins used as currency, but there are also oriental garments and dress-accessories (jewellery, buttons and belts), weapons, tableware, bottles, jugs, and various types of copper-alloy containers. Cypraea shells used as jewellery, and beads of cornelian and rock crystal, are counted amongst the material imported from the East. Ingmar Jansson, who has assessed the finds in Sweden of oriental character or origin in several studies, claims that these reveal significant oriental cultural influence in Sweden (Jansson 1988). At the same time, items such as typically Scandinavian jewellery (oval brooches) and Thor's hammer rings in Viking-period graves in Russia show that there was substantial emigration from central Sweden and Åland to Russia in the middle of the Viking Period. He proposes that the long-distance trade of the Viking Period along the eastern routes has been given too much attention in recent research when compared with the influence of other social processes such as mutual integration involving the exchange of goods, immigration, relocation, armed conflicts, and so on (Jansson 1987).

Acknowledgement

I wish to record my profound gratitude to the gemmologist Brenda Jensen for her invaluable contribution in assessing the semi-precious stones from Kaupang. Samples were examined with the help of microscope, refractometer and polariscope. My thanks also to goldsmith Nina Vedeler Svendsen for help in measuring the drilled holes in the gemstones from Kaupang.

Appendices 8.1–5

Catalogues

For finds from Blindheim's excavations, references are made to her catalogues and diaries kept in the archive of the KHM, Oslo. One piece of jewellery from the settlement, interpreted as cornelian in a copper-alloy frame (Heyerdahl-Larsen 1979b:152. fig.2), has proved to be amber. Two finds formerly thought to be rock-crystal beads have proved to be glass beads: Settlement excavation 1960, Trench MO, Blindheim: Cat. a. Settlement excavation 1962, Trench W, Blindheim: Cat. aa–rr.

Appendix 8.1

Cornelian

SETTLEMENT FINDS

Spherical bead (Hepp 2007:23–5, Form 1 and variants; Callmer 1977:Form T 001)

1. Blindheim: 1964. Trench D (?). Irregular form. Uneven surfaces. Munsell 10R 5/8 (red). Crypto-crystalline and translucent. No surface produces an RI reading. Many signs of incipient splitting. Drilled hole from two sides. Pit by the mouth of one drilled hole. L. 5.9 mm. Max. diam. 7.0 mm. Weight 0.4 g.

2. C52516/1833. Irregular form. Munsell 10R 5/6 (red). Uneven colour-variation. RI 1.54. Polycrystalline. Spherical with very uneven surface partly because of the attempt to remove dark inclusions near the surface. Drilled from one side. Pit by the mouth of the drilled hole on both sides. L. 7.0 mm. Max. diam. 7.8 mm. Diam. of hole c. 1 mm. Weight 0.6 g.

3. C52517/1630. Irregular form. Translucent. Munsell 10R 5/8 (red). Strong colour-variation between lighter and darker stripes. Polycrystalline. Drilled from one side. Pit/damage around the mouth of the hole. Cracking. L. 6.0 mm. Max. diam.6.7 mm. Diam. of hole c.1 mm. Weight 0.4 g.

4. C52519/11062. Regular form. Translucent. Munsell 10R 4/8 (red). Good colour but a dark sub-surface inclusion is visible. Crypto-crystalline. A circular hollow by the drilled hole on one side may be due to the removal of an inclusion. Quite a large crack forming across the bead. Apparently drilled from one side. L. 5.8 mm. Max. diam. 6.1 mm. Diam. of hole c.1 mm. Weight 0.3 g.

5. C52519/12132. Scorched bead, not fully round. Traces of possible facets, which may have been affected by the fire. Munsell 5YR 8/1 (white). A pink sheen under fibre-optic examination may indicate that the colour is still present under the white outer layer. Drilled from two sides. The two drilled holes meet at an angle of c. 160°. L. 8.0 mm. Diam. 7.3–8.3 mm. Diam. of hole 1.8 mm. Weight 0.6 g.

6. C52519/19993. Irregular. Some unevenness on the surface. Munsell 10R 4/8 (red). Signs of stripes of colour like agate. Good quality in terms of colour, translucency and the lack of disfiguring inclusions. Drilled from two sides. L. 5.4 mm. Diam. 5.6–6.4 mm. Diam. of hole 0.8–1.5 mm. Weight 0.4 g.

7. C52519/24591. Fig. 8.3a. Irregular surface. Munsell 10R 4/6(red). Low translucency but good colour. Pit/hollow by drilled hole on one side. L. 5.5 mm. Diam.5.7–6.0 mm. Diam. of hole 1.0–1.2 mm. Weight 0.3 g.

8. C52516/3858. Fig. 8.3b. Irregular form. Polished surface. Munsell 10R 3/6 (dark red). Agate-type colour-zoning and dark fills in cracks. Polycrystalline. Dark area beside one mouth of the drilled hole. Flattened beside one drilled hole. Drilled from two sides. Crooked hole. L. 10.2 mm. Diam.10.3 mm. Diam. of hole c.1.2 mm. Weight 1.8 g.

9. C52264/2 I. Irregular form. Uneven surface. Munsell 10R 6/3 (pale red) and 4/8 (red). Weak colouration. Hollows by the mouths of both drilled holes. The narrowest drilled hole where the pit is deepest. Presumably drilled from one side. L. 7.5 mm. Max. diam.7.6 mm. Diam. of hole c.1 mm. Weight 0.5 g.

Faceted discoid (round) bead (Hepp 2007:23–5, Form 7; Callmer 1977: Form T 005)

10. Blindheim: 1965. Fig. 8.3c. Trench D 1964/1965. Square F9. Find no. 56 (Blindheim: Diary 23). Regular form. Munsell 5YR 8/1 (white). Entirely white, cracked and crazed. No RI reading. Scorched. No visible red or pink colour, even using fibre-optics. Offcut beside one mouth of the drilled hole. Diam. 13.3–13.7 mm. Th. 4.7 mm. Diam. of hole c. 1 mm. Weight 1.3 g.

11. Blindheim: 1959. Fig. 8.3d. Trench BO. Beads zz (Blindheim: Catalogue 1, p.100). Regular form; the lateral surfaces polished. Munsell 10R 4/8 (red). Translucent. RI 1.54. Polycrystalline. Many red dots but no coloured stripes. L. 10.08 mm. Max. diam.10.1 mm. Diam. of hole c.1 mm. Weight 0.7 g.

12. Blindheim: 1962. Trench W. Square C8. Find no. 160 (Blindheim: Diary 11). Beads and glass s (Catalogue 2, p.41). Regular form. Munsell 10R 5/8 (red). Fine, even colour. Translucent. Polished sides but not the rim (belt). RI 1.54. Crypto-crystalline. Drilled from two sides. The two drilled holes do not meet on the same line so the channel is narrow. L. 10.2 mm. Max. diam. 10.6 mm. Th. 5.4 mm. Diam. of hole 1.5 mm. Weight 0.8 mm.

13. C52516/1760. Regular form. Strong colour-variation: red, orange and colourless. Munsell 10R 6/6 (light red), 10R 4/6 (red) and 5YR 8/1 (white). RI 1.54. Polycrystalline. Drilled from two sides. Crooked drilled hole. Diam. 10 mm. Th. 3.2 mm. Diam. of hole c.1 mm. Weight 0.4 g.

14. C52519/12172. Regular form. Translucent. Munsell 10R 6/8 (light red). Rather light in colour. RI 1.53. Polycrystalline. Polished to a sheen on both flat sides and the brim but rough on the rim (belt). Drilled from two sides; the holes meet at a slight angle. Inclusions, small cracks and many small red dots. Diam. 10.3 mm. Th.4.8 mm. Diam. of hole c. 1 mm. Weight 0.8 g.

15. C52517/2700. Regular form. Signs of faceting between the face and the brim (i.e. not entirely like Callmer (1977) Form T005). Translucent. Munsell 10R 5/8 (red). Good colour. No disfiguring inclusions. Drilled from both sides; the holes meet at a slight angle. Only half the bead is preserved. It is cracked across the drilled hole. Diam. c. 12.3 mm. Th. 4.4 mm. Diam. of hole c. 1 mm. Weight 0.5 g.

16. C52517/2132. Regular form. Translucent. Munsell 10R 5/6 (red). Good colour, even, with no inclusions. RI 1.54. Polycrystalline. Polished to a sheen on both flat surfaces and partly on the brim but rough on the rim (belt). Diam. 9.8 mm. Th. 4.8 mm. Diam. of hole 1.2 mm. Weight 0.6 g.

Faceted spherical bead (Hepp 2007:23–5, Form 8; Callmer 1977:Form T 010)

17. Blindheim: 1959. Trench BO. Find no. 401 (Diary 6). Beads gg (Blindheim: Catalogue 1, p.98). Irregular form. Opaque. Munsell 10R 4/8 (red), strongly agate-like colour-zoning (white flares on red). Coarse polishing lines. RI 1.54. Crypto-crystalline. Half the bead preserved. Holes drilled from both sides do not meet. The bead must have broken during drilling. L. 8.4 mm. Max. diam. 9.3 mm. Diam. of holes 0.8/1.3 mm. Weight 0.5 g.

18 Blindheim: 1964. Trench D. Square G 24. Find no. 311 (Blindheim: Diary 18). Beads aa (Blindheim: Catalogue 2, p.331). Munsell 10R 4/8 (red). RI c. 1.54 (difficult to determine). Crypto-crystalline. The bead is half-light and half-dark. The stripes in the light half consist of dotted layers. L. 9.5 mm. Diam. 10.4–11.2 mm. Weight 1.6 g.

19. C52519/11585. Fig. 8.3e. Regular form, very similar to Callmer (1977) T010.1. Well polished. The surface is polished in different directions. Crypto-crystalline. Munsell 10R 4/8 (red). Colour, translucency and the absence of inclusions attest to the high quality of the cornelian. Holes drilled from both sides meet at an angle. L. 9.6 mm. Diam. 9.3–10.1 mm. Diam. of holes 0.7–1.5 mm. Weight 1.3 g.

20. C52263/7. Regular form. Munsell 10R 5/8 (red). Fine colour and translucency. Very strong colour-variation. A cornelian-agate. Drilled from two sides.

L. 7.0 mm. Max. diam. 8.0 mm. Diam. of hole 0.6–1.0 mm. Weight 0.6 g.

Faceted polyhedrical bead (Hepp 2007:23–5, Form 9; Callmer 1977:Form T 007)

21. Blindheim: 1956–1974. Regular form. Munsell 10R 3/6 (dark red). Good colour and translucency. Inclusions with a light circle (a discus) around them, only visible under the microscope. Possible signs of the use of heat to improve the colour. The bead has not been completely drilled through. L. 10.7 mm. W. 10.3 mm. Th. 9.0 mm. Diam. of drilled hole 1.6 mm. Weight 1.9 g.

22. C52516/3857. Regular form. Relatively good translucency. Munsell 10R 3/6 (dark red). Coarse polishing on the end surfaces, otherwise well polished. RI 1.54. Polycrystalline. Some small red dots are the only inclusions. Drilled from two sides. L. 8.3 mm. W. 7.8 mm. Th. 5.9 mm. Diam. of hole 2.0 mm. Weight 5.9 g.

23. C52519/12068. Regular form. Varying polishing. Munsell 10R 4/8 (red). Fine colour but many inclusions. Small opaque minerals and brown discoloration of cracks. Drilled from two sides. L. 8.8 mm. W. 8.0 mm. Th. 6.4 mm. Diam. of hole c.1.7 mm, but about 1 mm where the two drilled holes meet. Weight 0.8 g.

24. C52519/11641. Regular form, closest to Callmer (1977) T0075. Polishing lines in different directions. Munsell 10R 5/6 (red). Partly opaque white. Fire-damaged. The colour may have been adversely affected by the heat. Agate-like stripes visible through the surface that is least damaged. RI 1.54. Crypto-crystalline. Drilled from two sides. L. 9.3 mm. W. 8.8 mm. Th. 6.2 mm. Diam. of hole 1.8 mm. Weight 0.9 g.

25. C52519/23154. Regular form. Munsell 10R 4/8 (red). Strong layering of colour. No disfiguring inclusions. RI 1.54. Polycrystalline. Less than half the bead preserved. Cracked through the hole. Drilled from two sides. L. 7.4 mm. Remaining W. 4.8 mm. Th. 5.5 mm. Diam. of hole c.1 mm. Weight 0.3 g.

26. C52519/10094. Fig. 8.3f. Regular form. Irregularities in the surface. Quite deep polishing stripes on some surfaces. Systematic polishing in a single direction on several surfaces. Munsell 10R 4/8 (red). Good colour, but disfiguring inclusions of iron oxide. RI c. 1.54. No sharp reading because of the slightly uneven surface. Crypto-crystalline. Drilled holes from two sides; the holes do not meet. L. 7.9 mm. W. 6.8 mm. Th. 6.0 mm. Diam. of drilled holes 1.4–2.1 mm. Weight 0.6 g.

Faceted prismatic bead (Hepp 2007:23–5, Form 10; Callmer 1977:Form T 009)

27. Blindheim: 1970. Trench C Square M1. Find no. 271. Beads p (Blindheim: Catalogue 2, p.7). Regular form. Translucent. Munsell 10R 3/6 (dark red). Well polished except for the end surfaces which have coarse polishing lines. RI 1.54. Crypto-crystalline. Holes drilled from both sides only just meet. An attempt has been made to remove a dark inclusion that lies in a hollow close to the mouth of the drilled hole by one of the end surfaces. L. 18.7 mm. W. 9.1 mm. Th. 6.7 mm. Diam. of hole c. 2 mm. Weight 2.1 g.

28. Blindheim: 1966. Trench BO. Find no. 116 (Blindheim: Diary 24). 7q (Catalogue 3, p.280). Regular form. Translucent. Munsell 10R 4/8 (red). Almost even red colour with a few darker stripes. No inclusions. Well polished. RI 1.54. A fragment preserved, broken through the drilled hole. Remaining L. 10.7 mm. Remaining W. 9.6 mm. Remaining Th. 6.0 mm. Diam. of hole 2.0 mm. Weight 0.7 g.

29. C52519/11892. Regular form. Scorched. Munsell 5YR 8/1 (white). Cracked through drilled hole. It is not certain that the drilling was completed. There is a small geode (a cavity containing crystals) in the centre of the stone. Cracking may also have been caused by fire. Chalcedon contains various amounts of water. Still a weak RI, 1.54. L. 15.6 mm. W. 10.1 mm. Th. 8.0 mm. Diam. of hole 1.8 mm. Weight 1.7 g.

30. C52519/12204. Regular form. Scorched. Munsell 5YR 8/3 (pink). Cracked through the drilled hole and elsewhere. Grooves visible running around the drilled hole. Remaining L. 5.2 mm. Remaining W. and Th. 8.7 mm. Diam. of hole 2.2 mm. Weight 0.3 g.

31. C52264/11 II (414). Fragment of a markedly faceted bead. Cracked through the drilled hole. Munsell 10R 4/8 (red). Good quality. Little evidence of wear. Grooves left by the drill visible in the hole. Remaining L. 7.6 mm. Remaining W. 6.8 mm. Weight 0.2 g.

Cabochon

32. C52517/2350. Oval cabochon with a domed face and flat back. A notch for possible mounting in a piece of metal jewellery on one long side and one of the cross sides. Low translucency. Munsell 10R 4/8 (red). Colour-zoning of agate-type. Well polished on the underside, matt on the face. L. 15.0 mm. W. 12.2 mm. Th. 8.3 mm. Weight 2.3 g. Possibly of more recent date.

SELECTED GRAVE FINDS

Faceted prismatic bead (Hepp 2007:23–5, Form 10; Callmer 1977:Form T 009)

33. Ka. 307. Found after the excavation had finished but "certainly belongs to the grave" (Blindheim and Heyerdahl-Larsen 1995:35). Regular form. Polishing lines in just one direction. Munsell R10 5/8 (red). Good colour, but not sufficiently translucent to be classified as of high quality. Varies in colour from light to dark along the length, but no clear striping effect. RI c. 1.54. Few signs of use. Drilled from two sides. L. 20.3 mm. W. 9.6 mm. Th. 7.4 mm. Diam. of hole 2.5–2.8 mm. Weight 2.6 g.

34. Ka. 286. Fig. 8.3g. Woman's grave in a boat, with oval brooches. The beads lay on either side of the deceased, but at different levels (Blindheim and Heyerdahl-Larsen 1995:85, Pl. 84e). Regular form. Translucent. RI 1.54. Well polished. Signs of two stages of polishing, finer over coarser. Munsell 10R 3/6 (dark red). Brownish red with many large and small red dots. The polisher has attempted to remove inclusions near the surface with a V-shaped notch. Slight wear. Drilled from two sides. L. 20.4 mm. W. 1.2 mm. Th. 0.9 mm. Diam. of hole 1.8–2.0 mm. Weight 3.6 g.

Appendix 8.2

Rock Crystal and Quartzite

Mineral optics have been used in some cases to confirm the identity of a bead or to draw conclusions about material from which a bead was formed. Here is a short account of the terminology used: Crystal *shape* is always described in relation to 3 intersecting axes. In quartz the axis that follows the longest direction in the crystal is called the *c-axis.* A lot of crystals have the property of dividing a light ray into two rays that take different paths through the crystal. These crystals are said to be *doubly refracting* or *birefringent.* Quartz is birefringent but it has one direction where there is no double refraction. This is called *optic axis* and in quartz the optic axis coincides with the c-axis. A polariscope can be used to find the position of the optic axis in any piece of quartz. One sees an *optic axis interference figure* which a) is unique to quartz so it confirms the identification and b) tells the direction of elongation for the crystal from which this bead was cut. This has been used in several of the elongated quartz beads to determine the relationship between long axis of the bead and long axis of the crystal from which it was cut. If a bead was cut from a small quartz crystal one would expect the long axis of the bead to correspond with the c-axis of the original crystal. If a bead has been cut from a lump taken from a large smashed crystal one would expect no such correspondence since fracture surfaces in quartz follow random directions.

SETTLEMENT FINDS

Spherical bead (Hepp 2007:23–5, Form 1 and variants; Callmer 1977:Form S 001–002)

1. Blindheim: 1958–1969. Irregular shape. Rounded. Partly reconstructed from three fragments. Badly worn surface. Crystal with many cracks. Quartz interference figure parallel with the drilled hole. Drilled from two sides. L. 15.2 mm. Max. diam.15.8 mm. Diam. of hole 3.2–3.6 mm. Weight 5.0 g.

2. Blindheim: 1964. Trench C. (Blindheim: Catalogue a–b). Regularly rounded. Well polished. Slight unevenness in the surface. Frosted surface. H c. 7, i.e. quartz. Drilled from one side. L. 10.8 mm. Max. diam. 11.5 mm. Diam. of hole 1.0–1.8 mm. Weight 1.9 g.

3. Blindheim: 1962. Trench W. (Blindheim: Catalogue a–ø). Regularly rounded. Well polished. Less than half the bead preserved. Material: quartzite. The drilled hole had almost passed right through the bead when the drill hit another dark mineral and the bead broke. Max. remaining L. 11.3 mm. Diam. of hole 1.5 mm. Weight 1.0 g.

4. Blindheim: 1959. Trench BO. (Blindheim: Catalogue m–w). Regularly rounded. Well polished. Single crystal of birefringent material. Quartz interference figure visible. Irregular pit alongside one edge of the drilled hole. L. 6.8 mm. Max. diam. 7.6 mm. Diam. of hole c.1 mm. Weight 0.5 g.

5. Blindheim: 1962. Trench C. (Blindheim: Catalogue a–dd). Regularly rounded. Well polished. Single crystal of birefringent material. Identified as quartz on interference figure. Flattened alongside one mouth of the drilled hole. L. 10.15 mm. Max. diam. 10.25 mm. Diam. of hole 1.7 mm. Weight 2.4 g.

6. C52516/4355. Regularly polished round. Single crystal of birefringent material. Quartz interference figure visible. The c-axis and drilled hole are not parallel. Drilled from one side. Pits alongside both mouths of the drilled hole, one more evident than the other. L. 9 mm. Max. diam. 10.2 mm. Diam. of hole 1.6 mm. Weight 1.4 g.

7. C52516/3554. Regularly polished round. Single crystal of birefringent material. Fine quartz interference figure. The c-axis at an angle relative to the line of the drilled hole. A flake has come off by the mouth of the drilled hole on one side. Drilled from one side. L. 7.0 mm. Max. diam. 7.5 mm. Diam. of hole 0.9–1.0 mm. Weight 1.2 g.

8. C52519/9881. Regularly polished round. An irregular hollow beside one mouth of the drilled hole has been partly polished over. Drilled from one side. The drilled hole is greater at one side than at the other. L. 8.8 mm. Max. diam. 9.8 mm. Diam. of hole 1.0–1.2 mm. Weight 1.1 g.

9. C52519/10296. Regularly polished round. RI cannot be measured. Probably quartz. Drilled from one side. Minor hollows at both ends of drilled hole. L. 5.8 mm. Max. diam.7.0 mm. Diam. of hole 1.8 mm. Weight 0.4 g.

10. C52519/10339. Fragment of evenly polished, rounded bead. Quartz. Remaining L. 7.8 mm. Remaining W. 6.8 mm. Remaining Th. 3.1 mm. Weight 0.2 g.

11. C52519/10619. Fragment of partially polished, rounded bead. Quartzite. Less than half preserved. Cracked through the drilled holes. Drilled from two sides. About 4.6 mm from each mouth of the hole the two ends are joined through a narrower drilled hole. Remaining L. 10.4 mm. Remaining W. 11.2 mm. Remaining Th. 5.7 mm. Diam. of the largest drilled holes 2.4 mm. Weight 0.7 g.

12. C52519/11021. Regularly polished round. A single crystal entirely drilled. The interference figure shows that this is quartz and that the c-axis is almost the same as the drilled hole. Drilled from one side. Pit beside one mouth of the drilled hole polished over. L. 10 mm. Max. diam.10.5 mm. Diam. of hole 1.6 mm. Weight 1.5 g.

13. C52519/12157. Evenly polished, rounded bead. A few irregularities. Quartz interference figure visible. The c-axis at an angle in relation to the drilled hole. Drilled from one side. L. 7.3 mm. Max. diam.7.8–7.9 mm. Diam. of hole 1.5–1.8 mm. Weight 0.7 g.

14. C52519/12736/1. Irregular form, almost round. Single crystal of birefringent material. No RI. H c. 7. Drilled from one side. Conspicuous hollow by the mouth of the drilled hole where it is narrowest. L. 6.5 mm. Max. diam. 7.5 mm. Diam. of hole 1.2–1.5 mm. Weight 0.5 g.

15. C52519/12736/2 Irregular form, almost round. Single crystal of birefringent material. No RI. H c. 7. Drilled from one side. Conspicuous, polished-over pit on one side of the drilled hole, and a smaller pit on the other side. L. 6.6 mm. Max. diam. 7.6 mm. Diam. of hole 1.2 mm. Weight 0.5 g.

16. C52519/19664. Almost round. Slightly irregular, polished and worn surface. Single crystal of birefringent material. H c. 7. Drilled from one side. L. 6.8 mm. Max. diam. 8.0 mm. Diam. of hole 0.9–1.2 mm. Weight 0.5 g.

17. C52519/16468. Evenly polished round. Single crystal of birefringent material. RI c. 1.55. Clearly visible quartz interference figure. Drilled from one side. Small, polished-over pit beside one mouth of drilled hole. L. 10 mm. Max. diam. 10.3 mm. Diam. of hole 1.0–1.2 mm. Weight 1.5 g.

18. C52519/10379. Quite evenly polished round. Partly opaque. Clear quartz interference figure visible in the polariscope. Drilled from two sides but primarily from one of them. L. 9.1 mm. Max. diam. 9.6 mm. Diam. of hole 1.1–1.5 mm. Weight 1.2 g.

19. C52519/18617. Fig. 8.5a. Very evenly polished. Translucent. Single crystal of birefringent material. Fine quartz interference figure. The c-axis at an angle in relation to the line of the drilled hole.

Drilled from one side. Polished-over, straight surfaces on either side connected with, but placed at an angle to, the mouths of the drilled hole. L. 9.0 mm. Max. diam. 12.4 mm. Diam. of hole 0.7–1.5 mm. Weight 2.4 g.

20. C52519/12738 W. Rounded, with slightly irregular surface. Single crystal of birefringent material. No RI measurement. H c. 7. Pits beside both mouths of the drilled hole. L. 6.3 mm. Max. diam. 6.8 mm. Diam. of hole 1.5 mm. Weight 0.5 g.

21. C52519/9881. Rounded. Semi-polished pit beside one mouth of the drilled hole. L. 8.8 mm. Max. diam. 9.5 mm. Weight 1.2 g.

Almost barrel-shaped bead/irregularly rounded bead (Callmer 1977:Form S 003–004)

22. C52519/11624. Irregular polished surface. Single crystal which is birefringent. Probably quartz. Drilled from one side. Hollows beside both mouths of the drilled hole. L. 5.5 mm. Max. diam. 6.4 mm. Diam. of hole 1.3 mm. Weight 0.4 g.

23. C52519/12180. Irregular polished surface. Single crystal of birefringent material. Probably quartz but no measurements possible. Polished-over hollows on both sides of drilled hole. L. 5.8 mm. Diam. 6.8–7.5 mm. Diam. of hole 1.2 mm. Weight 0.4 g.

24. C52516/2935. Irregular polished surface. Single crystal of birefringent material. Quartz interference figure clearly visible. It is does not follow the same direction as the drilled hole. Drilled from one side. One flake lost beside one mouth of the drilled hole. Pits beside both mouths of the drilled hole but more conspicuous on one side. L. 4.8 mm. Max. diam. 6.4 mm. Weight 0.3 g.

25. C52519/11429. Irregular polished surface. Single crystal of birefringent material. Probably quartz. Drilled from one side. Pits of different size by both mouths of the drilled hole. L 3.4 mm. Max. diam. 6.5 mm. Diam. of hole c. 1 mm. Weight 0.2 g.

26. C52519/27897. Fragment with a polished, rounded surface. Possible bead. Quartzite (polycrystalline). Max. dimension 6.8 mm. Weight 0.3 g.

Faceted discoid (round) bead (Hepp 2007:23–5, Form 7; Callmer 1977: Form S 008 and almost the same as T 005/2–3)

27. C52519/19665. Regular form. Translucent. Polished to a high sheen on the side and the brim, and matt on the rim (belt). Like Callmer (1977) T 005.2, cornelian. RI 1.55. Drilled from two sides with a drill of c. 1.3 mm diameter. The two drilled holes were then joined with a drill of 0.7 mm diameter. L. 9.2 mm. Th. 4.5 mm. Diam. 9.2 mm. Weight 0.6 g.

28. C52519/16467. Fig. 8.5b. Regular. Translucent. Well polished on the side and brim, matt on the rim (belt). Like Callmer (1977) T 005.2, cornelian. Single crystal of birefringent material. RI 1.55. Drilled from two sides. The drilled holes have been joined using a drill of under 1.2 mm diameter. L. 9.5 mm. Th. 3.8 mm. Diam.10 mm. Diam. of hole 1.2 mm. Weight 0.4 g.

29. C52264/12. Fig. 8.5c. Regular. Translucent. Well polished on the side and brim., matt on the rim (belt). Like Callmer (1977) T 005.2, cornelian. Birefringent crystal. RI 1.55. Many white inclusions. Drilled from two sides. The holes were joined by an exceptionally narrow drilled hole. L. 15 mm. Th. 3.8 mm. Diam. 15 mm. Diam. of drilled holes 1.1 and c. 0.1 mm. Weight 0.8 g.

Spherical faceted bead (Hepp 2007:23–25, Form 8; Callmer 1977:Form S 012)

30. Blindheim: 1960. Trench MO. (Blindheim: Catalogue cc–zz). Quartz. Irregular. Single crystal of birefringent material. Drilled from two sides. L. 6.6 mm. Max. diam.7.9 mm. Diam. of hole 1.5 mm. Weight 0.5 g.

31. Blindheim: 1960. Trench MO. (Blindheim: Catalogue cc–zz). Quartz. Irregular. Single crystal of birefringent material. Drilled from two sides. Drilled holes joined using a narrow drill. L. 9.8 mm. Max. diam. 9.7 mm. Diam. of hole 0.9–1.8 mm. Weight 1.3 g.

32. Blindheim: 1963. Trench C. (Blindheim: Catalogue a–ø/–y). Irregular. Five-sided in cross-section. Single crystal of birefringent material. RI not measurable. Quartz fragment. H c. 7. Drilled from two sides. L. 6.0 mm. Max. diam. 8.2 mm. Diam. of hole 0.9–1.8 mm. Weight 0.5 g.

33. C52516/2662. Regular form, almost as Callmer (1977) T 010,1. Single crystal of birefringent material. RI not measurable. H 7+. Drilled from two sides. Drilled holes joined using a narrower drill. L. 6.2 mm. Diam. 7 mm. Diam. of hole 1.0–1.8 mm. Weight 1.5 g.

34. C53160/368. Regular form. Fragmented; cracked along the drilled hole. Polished surfaces with coarse polishing lines. Grooves from drilling visible around the drilled hole through a magnifying glass. The traces of working may represent the following sequence: 1. Coarse polishing; 2. Drilling; 3. Fine polishing(?). Remaining L. 6.4 mm. Remaining diam. 8.4 mm. Diam. of hole 1.6 mm. Weight 0.3 g.

35. Blindheim: 1962. Fig. 8.5d. Trench D. Catalogue

a–g. Regular. Almost as Callmer (1977) T 010 but not entirely the same. Single crystal of birefringent material. Clear quartz interference figure. The faceted sides show wear. Drilled from two sides. L. 7.8 mm. Diam. 9.6 mm. Diam. of hole 1.3 mm. Weight 1.0 g.

36. C52263/8. Irregular. Surfaces of different shapes and sizes. In series Callmer (1977) S 012. Fragment. Quartzite. Drilled from two sides. L. 9.6 mm. Max. diam.10.5 mm. Diam. of hole 1.9 mm. Weight 1.7g.

Faceted polyhedrical bead (Hepp 2007:23–5, Form 9; Callmer 1977:Form S 009)

37. Blindheim: 1963. Trench D(?). (Blindheim: Catalogue a–k). Regular form. Translucent. Single crystal of birefringent material. RI 1.55. Characteristic quartz flaking. Polishing undertaken in several directions, first with a coarse abrasive powder, then with finer abrasive. The surface around the drilled hole is more coarsely polished. The bead has not been subject to much wear. The facet edges are still sharp. Drilled from two sides. L. 11.0 mm. W. 10.6 mm. Th. 7.5 mm. Diam. of hole 1.8–2.0 mm. Weight 1.7 g.

38. C52516/3187. Regular form. Translucent. Form as Callmer (1977) T 007. Single crystal of birefringent material. RI 1.54. Traces of use in the form of damage on the facet edges. Drilled from two sides. Drilled holes joined using a drill of c. 1.5 mm diameter. L. 0.9 mm. W. 10.2 mm. Th. 8.8 mm. Diam. of hole 2.3 mm. Weight 1.9 g.

39. C52519/10372. Relatively regular but with polished surfaces of different shapes. Quartz. Drilled from two sides. Small irregular hollows by the mouths of both drilled holes. L. 10.0 mm. W. 9.1 mm. Th. 7.5 mm. Diam. of hole 1.3–2.0 mm. Weight 1.3 g.

40. C52519/11098. Fig. 8.5e. Relatively regular but with polished surfaces of different shapes. Translucent. Simple birefringent crystal. RI 1.54. Quartz interference figure visible. Drilled from two sides. L. 7.5 mm. W. 7.2 mm. Th. 5.3 mm. Diam. of hole 1.0–1.2 mm. Weight 0.5 g.

Faceted prismatic bead (Hepp 2007:23–5, Form 10; Callmer 1977:Form S 011)

41. Blindheim: 1964. Trench D. Catalogue a–d. Like Callmer (1977) S 011.1. RI 1.55. Wear on the facet edges. L. 22.5 mm. W. 12.4 mm. Th. 11 mm. Diam. of hole 2.4 mm. Weight 5.8 g.

42. Blindheim: 1959. Trench BO. Catalogue pzz–pw. Like Callmer (1977) S 011.1. Characteristic quartz break surfaces. No measurements to confirm quartz. Wear on the facet edges. L. 10.9 mm. W. 11.8 mm. Th. 9.9 mm. Diam. of hole c. 2 mm. Weight 4.7 g.

43. C52519/9905. Relatively regular form. Fragment. Quartzite, with several small quartz crystals. Eight-sided cross-section. Remaining L. 8 mm. W. 10.3 mm. Th. 8.7 mm. Diam. of hole 2.1 mm. Weight 1.1 g.

44. C52519/10802. Regular form. The quartz interference figure shows there is no congruence between the long axis of the bead and the c-axis of the crystal. The bead was probably made out of a piece that did now show the crystalline form. This could explain why the bead is eight-sided in cross-section and not six-sided as is usual with quartz crystals. Marks of wear on the facet edges. Drilled from two sides. L. 15.1 mm. W. 11.2 mm. Th. 10.0 mm. Diam. of hole up to 2.5 mm. Weight 3.2 g.

45. C52519/12084. Relatively regular form. Single birefringent crystal. Well polished. RI 1.55. The c-axis is not congruent with the long axis of the bead. Traces of use in the form of worn and chipped sides. Drilled from two sides. The drilled holes are joined using a narrower drill. L. 17.7 mm. W. 9 mm. Th. 6.8 mm. Diam. of hole 1.0–1.8 mm. Weight 6.8 g.

Faceted biconical bead (Hepp 2007:23–5, Form 12; Callmer 1977:Form 015)

46. C52167/6. Form as Callmer (1977) T 013. Single birefringent crystal. RI 1.54.Characteristic quartz interference figure. The c-axis at an angle relative to the long axis of the bead. Traces of two directions of polishing, one coarse and one fine. A few remaining traces of the first coarse polishing. A little demonstrable wear. Drilled from two sides. L. 20.2 mm. W. 12.6 mm. Th. 11 mm. Diam. of hole c. 2 mm. Weight 3.2 g.

SELECTED GRAVE FINDS

Spherical bead (Hepp 2007:23–5, Form 1 and variants; Callmer 1977:Form S 001–002)

47. Ka. 299. Fig. 8.5f. Round bead. A birefringent crystal. The interference figure shows it to be quartz. Flattened at the mouth of the drilled hole on both sides. L. 11 mm. Max. diam. 14 mm. Diam. of hole 3 mm. Weight 2.9 g.

Faceted polyhedrical bead (Hepp 2007:23–5, Form 9; Callmer 1977:Form S 009)

48. Ka. 282. Form like Callmer (1977) S 009,2. A birefringent crystal. RI 1.55. Very weak reading because of wear. Coarse polishing lines visible. All stripes in the same direction. Wear on the facet edges. L. 13.2 mm. W. 9.4 mm. Th. 7.6 mm. Weight 1.3 g.

Faceted prismatic bead (Hepp 2007:23–5, Form 10; Callmer 1977:Form S 011)

49. Ka. 299. Fig. 8.5g. Rod-shaped. A single birefringent crystal. Traces of wear on the facet edges. Traces of polishing in two stages: coarse marks of polishing parallel with the side-edges and then fine polishing across these. L. 28.0 mm. W. 16.0 mm. Th. 12 mm. Weight 10.1 g.

Faceted biconical bead (Hepp 2007:23–5, Form 12; Callmer 1977:Form 0015)

50. Ka. 265. Fig. 8.5h, bottom. Different in shape from Callmer (1977) S 015 in that the facets with pointed terminals are plaited together, in turn, in the centre (18 facets: 8+8+2). Rock crystal. Because of a layer of (laquer?) that had been applied, the material could not be investigated in further detail. L. 24 mm. Max. diam. 12 mm. Diam. of hole 2.0 mm. Weight 5.2 g.

51. Ka. 265. Fig. 8.5h top. Form like Callmer (1977) T 013. Rock crystal. Because of a layer of (laquer?) that had been applied, the material could not be investigated in further detail. L. 23 mm. W. 14 mm. Diam. of hole 2.0–2.1 mm. Weight 4.5 g.

Appendix 8.3

Amethyst

SETTLEMENT FINDS

Amethyst beads

1. C52519/11461. Oval. The matt surface renders it difficult to look into the stone. Munsell RP 4/2 (Red purple). By examination in liquid it could be observed that the material is crystalline and has the correct linear colour-zoning typical of amethyst. Hardness over 6. Water-rolled material (pebble). L. 15 mm. W. 11.8 mm. Th. 7.6 mm. Diam. of hole 1 mm. Weight 2.2 g.

2. C52519/12156. Almost oval. Well polished. Munsell P 7/2 (Purple). Pale lilac colour with lighter parts. RI 1.55. Crystalline. Hardness over 6. L. 10.1 mm. W. 8.3 mm. Th. 6.3 mm. Diam. of hole 1 mm. Weight 0.6 g.

Appendix 8.4

Fluorspar

SETTLEMENT FINDS

Fluorspar beads CaF_2

1. C52519/16466. Fig. 8.9. Almost oval. Munsell P 4/8 (Purple). Strong purple colour. Characteristic straight linear colour-zoning. Signs of lamination in two directions. Hardness under 5. Thorough water-rolled material (pebble). L. 9.0 mm. W. 6.8 mm. Th. 5.7 mm. Diam. of hole c. 1 mm. Weight 0.6 g.

2. C52264/10. Pear-shaped (Callmer (1977) Form U). Colour-zoning purple/colourless. Signs of laminated surfaces in at least two directions. Hardness under 5. Water-rolled material (pebble). L. 9.1 mm. W. 8.4 mm. Th. 6.0 mm. Diam. of hole c. 1 mm. Weight 0.7 g.

Appendix 8.5

Garnet

SETTLEMENT FINDS

Raw material

1. C52519/11267. Garnet crystal. Rhomboidal dodecahedrons (12 rhomboidal surfaces). Almandine. Knotty surfaces. Slightly resinous sheen. Munsell 10R 2.5/2 (very dusky red). Cross-measurement 9.9–11.0 mm. Weight 1.7 g.

2. C52519/10307. Fig. 8.10. Garnet crystal. Rhomboidal dodecahedrons (12 rhomboidal surfaces) with one cubic surface visible. Almandine. Fine red colour visible using fibre-optics. Munsell 10R 2.5/2 (very dusky red). Cross-measurement c. 9 mm. Weight 1.5 g.

3. C52519/10268. Garnet crystal. Rhomboidal dodecahedrons (12 rhomboidal surfaces). The spectrum is almandine (i.e. a member of the pyrop-almandine series, towards the almandine end). Munsell 10R 2.5/2 (very dusky red). Slightly lopsidely developed (oblong). L. 9.6 mm. W. 8.0 mm. Th. 6.6 mm. Weight 1.3 g.

4. C52519/20389. Garnet crystal. Rhomboidal dodecahedrons (12 rhomboidal surfaces). Munsell 10R 2.5/2 (very dusky red). Max. cross-measurement 12.6 mm. Weight 1.2 g.

5. C52519/24203. Garnet crystal. Rhomboidal dodecahedrons (12 rhomboidal surfaces). Slight glitter on one side. Almandine. Munsell 10R 2.5/2 (very duskyred).Max.cross-measurement10.8mm.Weight 0.9 g.

Part II:

Tools and Utensils

Vessel Glass and Evidence of Glassworking 9

BJARNE GAUT

This chapter presents and discusses the glass finds from Skre's excavations in the settlement area of Kaupang 1998–2003. These comprise 322 vessel-fragments, nearly 700 pieces of raw material and waste from glassworking, and more than 30 other miscellaneous glass objects: window fragments, inlays and linen-smoothers. The work has three main aims. It explores what information the vessel sherds may provide about the presence of glass vessels on the site. It reviews the evidence for local glassworking and attempts to determine the raw materials used by beadmakers. Finally the assemblage is placed in the context of other Scandinavian and North European finds of glass, and some conclusions are drawn concerning the use and distribution of glass.

In addition to a typological study, spatial and compositional analyses are combined here to explore the archaeological potential of the material from the main research excavation (MRE). It is argued that the sherd assemblage predominantly represents complete vessels used within the buildings excavated. The glass was discarded in primary refuse areas to the side of the plots and in ditches when broken. It is established that the vessels are of types regularly found in western Europe in the 8th–10th centuries, and that the most frequently used vessel-forms were tall palm cups/funnel beakers and small jars. An estimated minimum number of 32–34 vessels were broken and deposited in the five excavated plots in the MRE area in the early 9th-century Site Periods (SP) I–III. The many unidentified sherds indicate however that the real number was somewhat higher – possibly around fifty. The analysis also revealed distinct differences in the frequency of vessel consumption and glassworking between the plots.

Small-scale glassworking also took place in this area during the first decade(s) of the 9th century (SP I and II:1). No *in situ* workshop floors or furnaces have been preserved, but the waste material indicates that glass beads were made from imported soda glass, blocks of raw glass, tesserae and semi-manufactured rods. A limited number of window-fragments, archaic vessel material and some untypical working waste suggest that imported scrap glass could also have been utilised, although this remains unproven. The products consisted mainly of translucent blue, green and opaque white annular beads, made in a winding technique similar to that seen on other (nearly) contemporary Scandinavian sites. It seems likely that the manufacture was carried out by itinerant artisans who brought their own raw materials. Although the preserved deposits in the MRE area represent a short time-span, the general scatter of production waste across the site suggests that beadworking may have continued in other areas or returned to the excavated plots in a later settlement phase.

With regard to vessel glass, Kaupang was primarily a consumption site. While the North Sea trade network provided direct access to a supply of glassware, there is no positive evidence for the re-exportation of material from Kaupang to its rural hinterland. It is argued that most of the glass was probably related to the consumption of wine. The use of glass and ceramic tableware was part of a material culture that distinguished traders and artisans in coastal market towns from the surrounding rural population.

9.1 Introduction to the material and general research problems

Nearly five thousand individual pieces of glass have been recovered from the settlement area at Kaupang from the archaeological excavations and surveys of 1998–2003. This chapter concerns 1,103 fragments of vessel glass, raw materials and waste from glassworking, and other miscellaneous glass objects. The large collection of glass beads (>3,800) will be published separately (Wiker 2003; 2007; in prep.).

In addition to providing an overview of the finds, the work has three main aims. Firstly, it will try to determine what information the material may yield on the presence and use of glass vessels on the site. Secondly, the evidence for local glassworking will be discussed, and an attempt made to clarify its relationship to the vessel assemblage. Finally some conclusions will be drawn concerning the distribution and consumption of Viking-period glass.

Archaeological work has established that Kaupang was a specialised production and market site with activity from about AD 800 to the mid-10th century (Skre 2007a, 2008e:199–202; Pilø and Skre, this vol. Ch. 2). Glass appears to have been deposited on the site throughout most of this period. However, post-depositional activities, principally later medieval and modern ploughing, have disturbed most deposits of the mid-800s onwards. This has obvious implications for the analysis of any group of small finds from the site.

Emphasis will be placed on the stratified, early 9th-century deposits from the MRE area. The relatively short chronological span of the stratified assemblage, combined with poor relative-chronological resolution, does not allow for detailed typo-chronological studies of the material. The finds nevertheless make an important contribution to our knowledge of 9th-century glass and its circulation in the specialised production and market sites of the period. The value of the assemblage lies in its well-documented settlement context, allowing detailed spatial analysis. The contextual information illuminates the use of glass and depositional activity on the site, and can also be used as a basis for more general considerations of the recovery rate of glass, the level of contemporary redepositional activity, and later disturbance.

The analysis of finds from the medieval and modern plough-layers will necessarily be more brief. Because they have been subject to different post-depositional processes and methods of recovery than the stratified Viking-period deposits, direct comparison of the two assemblages is difficult. The material provides some general information on the range and quantity of glass that was available on the site and may illuminate some chronological changes, but it is, for example, difficult to establish if the presence of glass was constant or fluctuated on the site during the late 9th and early 10th centuries. The modern ploughsoil also includes some post-Viking-period material. Attempts have been made visually to deselect both late medieval and modern glass from the assemblage, but inevitably there is some uncertainty attached to the dating of a number of undiagnostic sherds and fragments recovered from the ploughsoil (for further discussion see below, 9.2.7).

Figure 9.1 *Location of sites mentioned in the text. Map, Elise Naumann.*

9.1.1 Approaches to Early-medieval glass studies

Earlier approaches to Early-medieval glass have often concentrated on questions of typology and macro-scale distribution (e.g. Arbman 1937; Rademacher 1942; Harden 1956; Evison 1982a; Näsman 1984, 1986). The basis of much of that work has been the existence of a small number of well-preserved burial assemblages, from which both the range of vessel-forms and the influences on their style and decoration have been explored. Settlement material, on the other hand, has been considered of little independent research value because of its fragmentary character (Hunter 1972, 1975; Périn 1989:125–7; Stiff 1996:102–104). Few excavation reports go beyond descriptions of diagnostic fragments and discussions of typological questions in relation to these.

The last couple of decades have seen a shift in this approach. Although typo-chronological work is still important (see, for example, Lund Feveile 2006), it has come to be regarded as the empirical basis for further analyses rather than a goal in itself. This mirrors the increased attention generally given to the social significance of artefact assemblages and the agency of material culture in Early Medieval studies as in other fields of archaeology (Gerrard 2003:223–5). It is also a product of the focus on settlement excavations that recent years have seen, which has resulted in a growing number of heavily fragmented vessel assemblages. This has forced the development of a new methodology to exploit the research potential of the glass finds.


N
Borg
Nidaros
Staraja Ladoga
Hopperstad
Bergen
Oslo
Valsgärde
Sigtuna
Birka
Helgö
Huseby
Kaupang
Tarbat
Broa
Eketorp
Åhus
Lund
Dollerupsgårds Mark
Ribe
Trelleborg
Lagore Crannog
Eoforwic
Flixborough
Hedeby
Gross Strömkendorf
Pingjum
Wijnaldum
Brandon
Gipeswic
Dinas Powys
Lundenwic
Dorestad
Paderborn
Domburg
Winchester
Hamwic
Portchester Castle
Quentowic
Maastricht
Liège
Fulda
Cordel
Lorsch
St. Denis, Paris
Tours
Melle
Müstair
Sion
Castle Trosino
San Vincenzo
0
250
500 km

Figure 9.2 *Scandinavian glass finds from the Late Merovingian and Viking Periods (c. AD 700–1000).*
***A:** Furnished burials.*
Green circles = 8th century.
Blue circles = 9th–10th centuries.
***B:** Settlement finds.*
Red circles = Rural settlements.
Yellow circles = Specialised production and market places.
Map, Elise Naumann.

One way of approaching a fragmentary assemblage is through the large-scale application of quantitative (i.e. high-accuracy) compositional analyses. These may be used to assess the relationship between glass sherds within and between sites as well as to illuminate technological aspects and the levels of recycling (Hunter 1977:60–96; Henderson 2000:24–108; Wedepohl 2003). Analytical work carried out during the last two decades has made valuable contributions to our general understanding of production and distribution of Early-medieval glass. Isotopic work is beginning to provide high-precision data on the geographical origin of the raw materials of the glass.

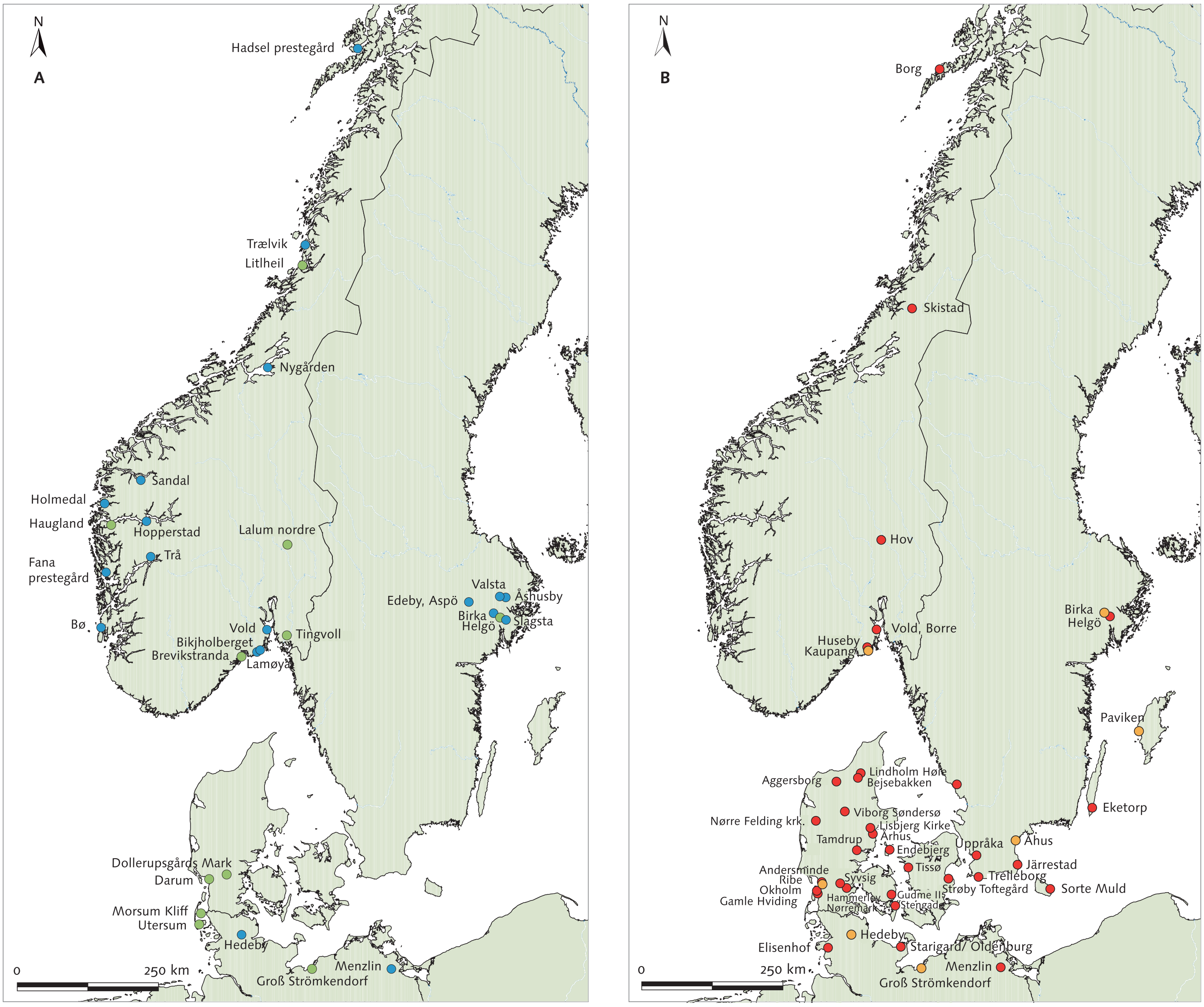
Sherd assemblages may, however, also provide much information about activity patterns and site-formation processes if they are studied in detail. To realise this potential, the development and application of a new set of archaeological methods, in many cases borrowed from other archaeological subdisciplines, has been necessary. Amongst the most promising are advances in quantification techniques and statistical approaches to characterise and compare vessel assemblages (Cool 1994; Cool and Baxter 1996), and techniques for intra-site spatial analysis through refitting and studies of fragment dispersal (Campbell 1991:21–40, 2000:37–8; Høie 2006; Gaut 2007). These approaches can greatly improve understanding of the use and social significance of glass in Early-medieval societies. They also have the beneficial side-effect of integrating the interpretation of glass with other aspects of archaeological analysis more fully.

Early-medieval glass distribution

The range and quantity of glass finds from Kaupang distinguish the assemblage from other Viking-period finds in present-day Norway (Hougen 1968; Holand 2001:appendix 1). Most other finds are fragments either of a single or of a small number of vessels from well-furnished burials. In southern Scandinavia, on the other hand, glass comes almost exclusively from settlement excavations (Fig. 9.2). Only a few of the rural settlement assemblages have produced sherds of more than one or two vessels, occasionally with some additional glassworking waste (for recent updates see Näsman 2000; Sindbæk 2005). On the other hand, the Kaupang finds share many characteristics with assemblages from the specialised production and market sites that developed around the North Sea and in the Baltic during the 8th and 9th centuries. At these sites, artefacts of glass appear to have been more readily available (see Stiff 2001, with refs. for a general overview). Many of these sites, such as Ribe (Sode 2004; Lund Feveile 2006), Åhus (Callmer 1990, 2002; Callmer and Henderson 1991), Groß Strömkendorf (Pöche 2005) and Hedeby (Dekówna 1990; Steppuhn 1998) have also yielded substantial collections of waste material indicative of glassworking.

Two apparently conflicting models have been employed to explain this distribution of vessel glass in Scandinavia. According to one of these, it is seen as a continuation of a pre-market gift-exchange. Finds from furnished burials are often considered to be prestigious luxuries, exchanged through personal contacts between individual Scandinavian chieftains and people on the Continent or in the British Isles (Hougen 1968:103–4; Näsman 1986:96–107; Holand 2000:82–4). Simultaneously, though, the Viking Age is regarded as the period when Scandinavia first was drawn into the network of commercialised long-distance trade (Näsman 1991; Sindbæk 2005). Although glass vessels from the large trading sites are generally regarded as luxury items, scholars have been more willing to see their distribution, at least within the network of market sites, as evidence of commercial transactions. A possible way of harmonising the two models is to regard the specialised production and market places as gateway communities bringing goods into a region, while distribution beyond these sites was carried out in practice through a variety of mechanisms (Capelle 1988; Näsman 1990:100–1; Näsman and Roesdahl 2003:290–4).

How realistic these models are for the circulation of vessel glass in Scandinavia and to what extent the extant distribution pattern provides a satisfactory impression of the availability of glass at the time can, however, be questioned (Näsman 1984:26–34, 1990:90–4). The pattern of furnished burials clearly provides no adequate guide to this problem, in either northern or southern Scandinavia (Bakka 1971; Hunter 1975; Blindheim et al. 1999:53). There are serious methodological problems related to the recovery of glass from surveyed and excavated settlements (Gaut 2007:32–4), and the dearth of identified, let alone excavated, Viking-period settlements



over much of present-day Norway, Sweden and eastern Denmark exacerbates the problem of assessing glass distribution.

One possibility is that glass was present in rural districts of northern Europe to a much greater extent than previously thought (e.g. Evison 2000:86–8; Näsman 2000:42–3; cf. the more pessimistic assessment of Jutland in Sindbæk 2005:151–61). The body of evidence from so-called central places, specialised production and market sites, and more ordinary farmsteads in southern Scandinavia – producing assemblages that are highly variable in quantity and make-up – indicates that distribution may have been quite uneven. One of the more surprising discoveries has been the large vessel assemblage excavated at the chieftain's farm of Borg in Lofoten (Nordland) from 1983–1989 (Henderson and Holand 1992; Holand 2003a). Although the 114 fragments, probably representing 10–15 vessels, had accumulated over a period twice the duration of activity at Kaupang, this number of fragments from a farmstead situated near to the climatic boundary for arable farming is considerable, and raises the question of how untypical the large amount of glass at Kaupang really was.

I have argued elsewhere (Gaut 2007:32–4) that our current understanding of glass distribution is over-dependent upon simplified economic or anthropological models, and that in the past there has been a lack of both will and of well-published data to test and develop the interpretations of the archaeological material. In my opinion, the critical factor for understanding Kaupang's vessel glass and the site's relationship to a wider pattern of glass distribution must be a detailed interpretation of the context and of the assemblage itself.

Based on a discussion of the Helgö material, Agneta Lundström has suggested four models to explain the presence of large glass assemblages (especially vessel glass) in a settlement (1981:19–22). The assemblage may represent: 1) a *production site,* where glass was fused from primary raw materials; 2) a *glassworking site,* where vessels, or perhaps more frequently beads, were produced from imported raw glass; 3) a *consumer site* where the vessel glass represents beakers and bowls utilised by the population; or 4) a *trade centre,* through which commodities passed on their way to end-users elsewhere. On the assumption that different types of site would produce slightly different assemblages and intra-site distribution patterns, it should be possible to distinguish between these categories. The first possibility, that glass was produced at Kaupang, can be excluded from further discussion on the weight of the present evidence. No examples of semi-fused raw materials (*frit*) have been identified, nor have any furnaces or large deposits of waste glass typical of such sites been uncovered during survey work or excavations. It is generally understood that glass was only produced in Scandinavia from the 16th century onwards (Ingemark 1995). The distinctions between models 2, 3 and 4 are more subtle, and will be considered below (see 9.2.6, 9.4.3 and 9.5.1).

Previous research on the Kaupang glass: the possible relationship between vessel glass and beadmaking

Excavations in the settlement area at Kaupang from 1956–1974 by Charlotte Blindheim brought glass to light that is very similar to the assemblage presented here. Many of the questions that were raised at that time still remain unanswered and have influenced the current research agenda. In a preliminary statement on Blindheim's glass finds, Ellen Karine Hougen (1969a) argued that much of the material was probably associated with local bead production. Although a small number of complete glass vessels may have been brought to the site, she suggested that no organised importation or exchange of vessels took place (1968:104–5, 1969a:123–6). Instead, much of the heterogeneous assemblage of vessel sherds and other glass objects was regarded as cullet imported for beadworking. She supported her interpretation by reference to the virtual absence of glass finds in the excavated graves at Kaupang (in contrast to Birka), which seemed to reflect a very limited circulation of vessels (Hougen 1969a:131–2; see also Sode 2004:88 for a similar argument; cf. Appendix 9.2). Hougen further emphasised that where graves contained vessel glass these were, with the exception of Ka. 304, single sherds likely to have been regarded as amulets, keepsakes, or tokens of complete vessels.

In many ways Hougen's 1969 article is typical of its date. At this time, post-Roman glassworking was considered to have been an industry in decline, and glass was thought to have been in short supply in western Europe throughout the second half of the first millennium AD (Rademacher 1963 [1933]; Hougen 1968). Recycling was assumed to have played a significant, if not a quantifiable role, in the continuous availability of soda-lime-silica glass (e.g. Jackson 1996, with refs.; Stiff 2001:43–5; Sode 2002). Glass vessels were regarded as luxuries, and were not considered to have circulated in any numbers beyond the core areas of production in the Rhine area and present-day France/Belgium.

It is on this background one must see the willingness to interpret glass assemblages from "barbarian" areas outside of glass-producing areas as collections of cullet and raw material for beadmaking (see, for example, Alcock 1963 and Campbell's 1991 reinterpretation of the material from Dinas Powys, Wales, and the discussion of Helgö in Holmqvist 1964:258–60 and Lundström 1981:19–22). However, the excavation of several glass factories in the Near East during the 1970s and 80s showed that the production and distribution of large quantities of fresh glass continued throughout the Early Middle Ages (Whitehouse 2003, with refs.). From the 8th century onwards, imported soda-lime-silica glass was gradually supplemented with (and eventually replaced by) potassium-rich glass produced in Europe. This new evidence suggests that a growing European demand for window and vessel glass in the Merovingian and Carolingian Periods may not have been satisfied through recycling – or at least that recycling took place on a much smaller scale than previously assumed (Foy et al. 2000; Picon and Vichy 2003:27–30; Wedepohl 2003, esp. 89–91 and 140–1).

A distinction should probably be maintained between the raw materials required by glass manufactories producing vessels or window panes and those used for the more decentralised beadmaking that has been documented in Scandinavia.[1] While it seems reasonable for large-scale glassworking

1 Knorr's claim [1913] to have uncovered a furnace for glass-blowing in Hedeby is disputed, and there is little positive evidence that glassmaking or glass-blowing took place on the site (*contra* Jankuhn 1986:199). The furnace remains and glass waste should probably be associated with the production of glass beads or enamels (cf. Dekówna 1976:66; Steppuhn 1998:94–6).

2 Publication of the glass from Blindheim's settlement excavations is currently being prepared (Hougen, in prep.), and the material has therefore been outside the remit of the present work. The author has nevertheless been given access to study the glass finds briefly, and some of the assemblage is on permanent display in KHM in Oslo. A short assessment by Matthew Stiff (1996:293–6), recording his impression of the character and condition of the assemblage, the main vessel-forms, and the decorative techniques applied, is also available. Although his notes are brief and concern only the vessel glass, they are useful because they compare the assemblage with those of other Early-medieval specialised production and market sites in the North Sea area, and record the same set of parameters.

to have been based predominantly on the importation or (from the late 8th century) local production of new glass, it is possible that small-scale secondary glassworking, such as beadmaking, could make use of both specialised raw materials and semi-manufactures, as well as more randomly collected cullet. With regard to Kaupang, Hougen commented (1969a:130) that the complete remelting of scrap glass would require a proper furnace and also the know-how to control the colour of the batch. It is questionable whether such structures were to be found at Kaupang (cf. below, 9.4.3), and Hougen considered the melting and drawing out of rods from individual sherds more likely. The question of recycling has mainly been discussed from the point of view of chemical composition and glass availability. With the exception of some ethnological studies (Kock and Sode 1994; Sode 1996) and experimental work carried out by Tine Gam Aschenbrenner (Gam 1991; Gam Aschenbrenner 1999) little has been done to address how, in practical terms, glass would be remelted at a glassworking site. Gam Aschenbrenner's work suggests that vessel glass *could* be reworked but that it is not ideal as a raw material for glass-bead production because gas bubbles and impurities will often be trapped in the matrix when fusing the thin sherds together. Thick, compact material with a small surface compared to body mass is better suited. This would favour chunks of raw glass (or vessel base-fragments) that could be remelted directly or chipped to an appropriate size before reshaping into rods and beads. How these experiments relate to the archaeological data is, however, difficult to establish. As Alexander Pöche (2005:15) has pointed out, beadmaking waste and vessel glass are rarely studied and published together, and it is difficult to explore whether there is a relationship between them. By analysing both the vessel glass and the material indicative of glassworking from Kaupang I hope to contribute to a more integrated approach to these issues (see also Wiker, in prep.).

In her discussion of glass recycling at Ribe, Lene Lund Feveile (2006:254, fig. 37, reproduced here as Fig. 9.61) has attempted to distinguish between sherds representing complete vessels brought to the site and primary, secondary and tertiary waste material. She defines *primary waste* as

> …waste from the production of glass vessels, for instance flat pieces with a little edge – trimmings from the glass production, and defective or unsuccessful glass vessels… [Secondary waste] consists of sherds of glass vessels damaged while being transported, so that they have never reached the end-user. These are sherds of glass vessels that show no sign of defects arising in the production or of wear from use… [Tertiary waste] consists of glass sherds from vessels that have been used for a period by an end-user. When the glass broke the sherds would have a certain value and would therefore have been collected locally. The sherds would have no sign of production-defects, but might to some extent show signs of wear, e.g. on the standing-surface in the form of scratches etc.

Although this distinction provides some intellectual clarification, it is based on formal morphological criteria that, with the exception of primary production wasters, are rarely identifiable in a fragmentary assemblage. A combination of Lund Feveile's morphological approach with spatial and compositional analyses is nevertheless likely to enhance the understanding of what the extant glass represents.

Unfortunately, Hougen's material has not yet seen full publication.[2] It is therefore difficult at present to assess her ideas about cullet recycling at Kaupang. Moreover, uncertainties attached to Blindheim's interpretation of the excavated structures and their stratigraphical relationships (cf. Pilø 2007a) make it unlikely that the contextual relationship between different categories of glass finds will ever be established. The preponderance of stratified material from the 1998–2003 fieldwork leaves one in a better position to investigate the use of vessel glass at Kaupang, and to consider what relationship there is – if any – between the presence of vessel glass on the site and the local manufacture of beads. It is plausible that the material represents a combination of several of Lundström's models, and it should be stressed that the presence of beadworking, and even a theoretical recycling of vessel sherds in the settlement, does not exclude contemporary use or trade in whole glass vessels on the site.

9.1.2 Material overview

Objects of glass found in the settlement area at Kaupang have been deposited at KHM on a number of different occasions over the last 10 years (Tab. 9.1). The archaeological fieldwork has been carried out by the Kaupang Excavation Project, either as heritage management excavations or research-directed interventions (Pilø 2007b; Pilø and Skre, this vol. Ch. 2:Fig. 2.3). Although finds from different interventions are given separate inventory numbers, they will be treated here as one body of evidence, which in the further analyses is classified by find context than date of recovery.

Artefact recovery

A rigorous method of artefact recovery was employed at Kaupang. This is treated in detail elsewhere (Pilø 2007b), and only aspects of the methodology that have direct relevance to the glass assemblage will be commented upon here. During the initial stages of fieldwork the site was intensively fieldwalked. This was generally carried out at low

Inventory no.	Intervention	V	W	M	R	T	PW	(Rods)	Frags.	Sum
C52003	Field surveys spring 1998	11					17	13	2	30
C52167	Surface recovery 1999	4					4	2		8
C52263	Field surveys autumn 1999	1			2		5	3	3	11
C52264	Field surveys spring 1999	25			7	2	38	29	4	76
C52265	Evaluation trenches autumn 1999	6					3	1	2	11
C52516	CRM 2000–2003	48	3	1	13	6	102	74		173
C52517	Surface recovery 2000–2002	16	1		6		28	20	3	54
C52519	MRE 2000–2002	208	15	11	44	12	383	242	50	723
C53160	Evaluation trenches harbour 2003	3				1	11	7	2	17
	Total	322	19	12	72	21	591	391	66	1103

Table 9.1 *Overview of glass finds made at Kaupang 1998–2003 (excluding beads). The figures include only finds related to Viking-period activity. V=Vessel glass; W=Window glass; M=Miscellaneous objects; R=Raw glass; T=Tesserae; PW=Production Waste; (Rods)=Proportion of rods amongst production waste; Frags.=Undiagnostic fragments. For the artefact classification, see 9.1.3, below.*

speed with two metres between the surveyors, and was done up to four times in the various settlement areas. Some objects of glass were also collected by metal detectorists but on a less systematic basis.

The amount of post-medieval material present in the ploughsoil caused a significant problem for the surveyors. In the case of glass, rods and glass beads were always collected. Vessel glass, on the other hand, was collected only if the fabric was "thin" and the matrix contained bubbles. Window glass was sometimes disregarded and sometimes collected following these guidelines. Because durable glass causes no serious strain on conservation resources a significant number of finds later determined to be post-medieval were initially collected for assessment. During the post-excavation process, about 150 vessel- and window-glass fragments were discarded outright. In addition, about a hundred fragments initially catalogued were later excluded as modern. There is still some uncertainty with regard to the dating of some of the raw glass and of 38 undiagnostic vessel-fragments from the ploughsoil (about 12% of the total vessel assemblage). It is likely that the application of a compositional analysis technique such as XRF or EPMA would distinguish at least some post-Viking material. However, it was not thought that this would provide significant new information and this possibility has therefore, with the exception of some raw glass, not been pursued.

In addition to the surface assemblage, about 35% (95 cu m) of the modern ploughsoil covering the MRE site was water-sieved through a 5 mm mesh. Despite the large amount of glass collected, this material is heavily fragmented and displaced, and must be considered of limited research value in itself (below, 9.2.7).

Collection of small finds from the stratified deposits (including the later medieval plough-layer) was mainly carried out through water-sieving. All excavated deposits (a total of 120 cu m) were 100% sieved through a 5 mm mesh. However, the first ten litres, and a minimum of 20% of the total volume from each context, was sieved through a 2 mm mesh. All the glass finds were collected and catalogued, and the rate of recovery must be regarded as exceptionally good (below, 9.2.4). This is clear in the large amount of small fragments and splinters of glass recovered from the site.

Forty per cent of the glass finds from Kaupang are from stratified Viking-period deposits (Tab. 9.2) – three-quarters of which can be closely dated to between c. AD 800 and c. AD 900 (SP I–III in the MRE area). Another 15% of the finds have been made in the later medieval plough-layer covering parts of the site, while the remaining 45% are from the modern ploughsoil.

Earlier finds

A comparative overview of earlier finds of glass from Kaupang (not including beads) can be found in Table 9.3. The finds are all published elsewhere or currently under publication (Blindheim et al. 1981, 1995, 1999; Hougen 1969a, in prep.; Gaut 2004, 2005b) and will therefore only summarily be treated here. The assemblages constitute important reference material, and can help to provide a fuller understanding of the use of glass at, and in the vicinity of, Kaupang.

Until 1956, the cemeteries surrounding Kaupang were the main focus of archaeological activity. Finds from approximately 160 graves have been recorded. Artefacts of glass, other than beads, are extremely rare (Appendix 9.2). Only five of the excavated graves contained fragments of vessel glass, and only

Context	V	W	M	R	T	PW	(Rods)	Frags.	Sum	%
SP I, II, and III	65	3	1	11	5	198	140	27	310	28.1%
SP I-III	18		2	2	3	22	10	5	52	4.7%
Without SP	22	2	1		1	56	36	2	84	7.6%
Late-medieval plough-layer	47	5	3	11	5	86	56	5	162	14.7%
Modern ploughsoil	168	9	5	48	7	224	149	26	487	44.2%
Uncertain	2					5		1	8	0.7%
Sum	322	19	12	72	21	591	391	66	1103	100.0%

Table 9.2 *Viking-period glass finds from the Kaupang settlement area 1998–2003 (excluding beads), distributed by datable contexts. V=Vessel glass; W=Window glass; M=Miscellaneous objects; R=Raw glass; T=Tesaserae; PW=Production Waste; (Rods)=Proportion of rods amongst production waste; Frags.=Undiagnostic fragments. For definition of Site Periods and the stratigraphical nomenclature see Pilø and Skre, this vol. Ch. 2:23–6, Fig. 2.6. For the artefact classification, see 9.1.3, below.*

Ka. 304 and Ka. 305 have yielded more than single sherds. Blindheim (et al. 1999:123) and Hougen (1969a:131–2) have suggested that some of the sherds could be interpreted as tokens of complete vessels or as objects with an amuletic function. Alternatively, they could be redeposited material. The only *possible* exception to this is Ka. 304 which contains five sherds from the upper wall section of a light blue-green funnel beaker. Deposition of complete vessels of glass and pottery does not appear to have played a significant part in the regional burial custom during the Viking Age (Blindheim et al. 1999:53–7; Hougen 1969a:123, 1993:8–9).

The glass finds from Blindheim's settlement excavations of 1956–1967 are being published by Ellen Karine Hougen, and only a short preliminary evaluation is so far available (Hougen 1969a; cf. Stiff 1996:293–6). Personal observation confirms, however, that the material is by and large of a similar character to that discussed here. The finds uncovered in 1999–2001 on the hall platform at Huseby, 1 km from Kaupang (Gaut 2004; Skre 2007f:234–43), and a small number of surface finds recovered during surveying at Nordre Kaupang and Lamøya in 2005 (Kristensen and Berg-Hansen 2005), must also be noted.

9.1.3 Definitions and classification of the material

The Kaupang glass assemblage comprises a wide range of different object-types. Most of the *vessel-* and *window*-fragments are easily distinguished on the basis of their morphology and/or applied decoration. Some very small or heat-exposed *fragments* have been impossible to classify. The other sherds have been described using a set of parameters developed by Matthew Stiff (1996). The most vital of these are summarised below.

Shape describes the vertical profile of the exterior of the vessel. Together with the rim shape, internal curvature and other clues to the manipulation of the glass (e.g. the direction of bubbles in the matrix) are the best bases of identification of the *vessel-form*. Knowledge of the range of vessels in circulation during the Viking Age depends to a large extent on preserved examples from Scandinavian furnished burials – the representativity of which is subject to question. Nevertheless, the known forms

Inventory no.	Intervention	V	W	M	R	PW	T	Sum
C54272, C54290	Survey 2005	2		1		1		4
C52518	Huseby 1999–2001	6			4	6		16
C4206–16, C4317	Nicolaysen's cemetery excavations 1867			1		1		2
C21960	Gustafson's cemetery excavations 1902					1		1
K-	Blindheim's cemetery excavations 1950–1957	11				3	1	15
K-	Blindheim's settlement excavations 1956–1974	240	16	9	25	200	4	494
	Sum of artefacts	259	16	11	29	212	5	532

Table 9.3 *Glass finds (excluding beads) from the hall site at Huseby and previous excavations at Kaupang. The finds from Blindheim's excavations have no formal inventory numbers (K-). V=Vessel glass; W=Window glass; M=Miscellaneous objects; R=Raw glass; PW=Production Waste; T=Tesserae. For a breakdown of the figures and a definition of the different categories, see 9.1.3 and Appendix 9.2.*

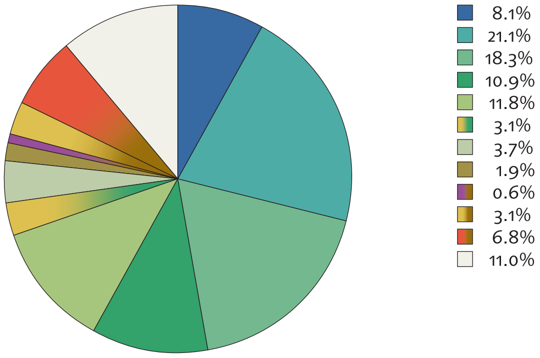


Figure 9.3 *Range of vessel colours (N=322). The diagram does not illustrate depth of colour. The nearly colourless fragments are invariably of very faint green or blue tints.*

Figure 9.4 *Decorative elements recorded on the Kaupang vessel glass. N=322.*

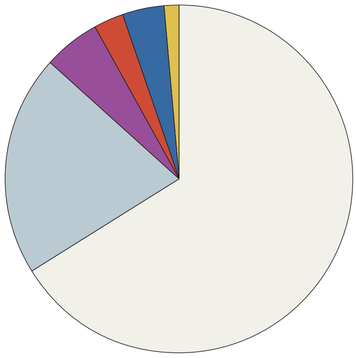
include conical and funnel-shaped beakers, bowls, and various squat jars, as well as some small bottles. *Decorative elements* include the application of self-coloured or contrasting (mainly yellow or white) trails, bichrome twisted cables (reticella) and coloured "*in calmo*" rim sections, mould-blown or optic blown ribs and bosses. *Vessel-type* is used to describe the combination of vessel-form and decoration: for example a squat jar with applied vertical reticella rods and horizontal trailing. Where several sherds from the same vessel-type are believed to derive from one original vessel, they are referred to as a *Sherd Family* (SF) (further, 2.4). A detailed list of the sherds in these groups and a description of their context can be found in Appendix 9.3.

There is no common standard for description of glass *colour* (Hunter 1980:71–2; Sanderson and Hutchings 1987; Hunter and Hayworth 1998:34–41). A standard colour chart, like Münsell, could be used, but since the perception of the colour is influenced by, inter alia, the thickness of the glass, the colour of surrounding glass, the state of preservation, and the light source, this seems unnecessarily complicated as well as being of little practical use to the general reader. As a pragmatic solution, I have chosen to describe the colour in terms of combinations of up to two from a relatively short list of possibilities, of which the first defines the main colour tinge. Blue-green thus refers to a green colour with a blue tone. This compound descriptor is modified by a prefix describing the depth of colour as well as a note on translucency or opacity: for example translucent very light blue. All colours are described in transmitted light, with the exception of dichroic glass where colour is defined both for transmitted and reflected light. To achieve as consistent light conditions as possible, the material has been studied in "white" lamp-light.

The other large category of material at Kaupang is *production waste* from glassworking, most of which is to be associated with local beadmaking. The classification developed by Johan Callmer for the Åhus glass (Callmer and Henderson 1991:fig. 1) has been followed with minor adjustments. Typical of the beadmaking technique used at Kaupang is the presence of semi-manufactures and wasters such as plain and twisted *rods* and *rod ends* created by drawing out the glass prior to winding it around a mandrel (see 9.4, below, for further discussion). Judging from the tool-marks sometimes preserved, this was carried out using a pair of tweezers or small pliers. Other characteristic forms are swellings in the rod due to impurities in the matrix, and the shape of the transverse rod splinters. There is also a number of small smelt *drops* and *failed beads*, as well as a range of other undiagnostic melt products. In most cases these definitions are self-explanatory. In some cases one might suspect that the finds represent finished products (especially beads) that have been deformed through secondary heat exposure. However, these occasional uncertainties should not affect the main conclusions. Finished beads have been classified in accordance with Callmer's system (1977).

In addition to the molten and part-molten production waste, both glass tesserae and *raw glass* have been found at Kaupang. The raw glass is with few exceptions preserved only in the form of chips and splinters broken off from larger chunks or ingots of glass, and can normally be identified on the basis of the absence of smooth outer surfaces. On other sites it has been possible to establish that the splinters derive from small bun-shaped glass cakes (Callmer and Henderson 1991:144, fig. 2). Such ingots can be difficult to distinguish from fragments of compact linen-smoothers present in the settlement area.

Together with a small number of other *miscellaneous objects*, linen-smoothers are discussed in 9.3.2 (below). This group also includes glass used as inlays in jewellery or decorative mounts. These are small, predominantly plane fragments of glass (*not* enamels or glass paste) that have deliberately been shaped to acquire a specific geometrical form. The distinc-



tion between jewellery inlay and small, shaped window-fragments can be difficult to draw. One glass cabochon is also included in this group.

The contexts of all the finds have been characterised as far as possible and dated in accordance with the excavation reports and the site publication (Pilø et al. 2000, 2003; Wiker 2001; Pedersen and Pilø 2007; Pilø 2007c). For a description of the stratigraphical nomenclature the reader is referred to Pilø and Skre (this vol. Ch. 2:Fig. 2.6). Combined with an assessment of their morphology and matrix, the individual objects have been labelled *Viking-period, Probably Viking-period*, or of *Uncertain Date*.

Within the framework of this study, a series of compositional analyses has also been completed on samples from all the different artefact-groups. The work has been carried out by David Dungworth of English Heritage and Julian Henderson of the University of Nottingham (Gaut 2006; Dungworth et al. 2007). The *electron probe microanalysis* (EPMA) samples are numbered KAU 1–94, and the samples analysed by *energy-dispersive x-ray fluorescence analysis (EDX)* KAU 95–116. In addition, a small number of the samples have been subject to isotope determinations with the help of Bernard Gratuze of the Centre National de la Récherche Scientifique (CNRS, France) and Jane Evans of the British Geological Survey (Guerrot 2007; Gaut et al., in prep.). Details of this work can be found in Appendix 9.1, but the results are occasionally referred to in this chapter to substantiate the argument.

9.2 Vessel glass

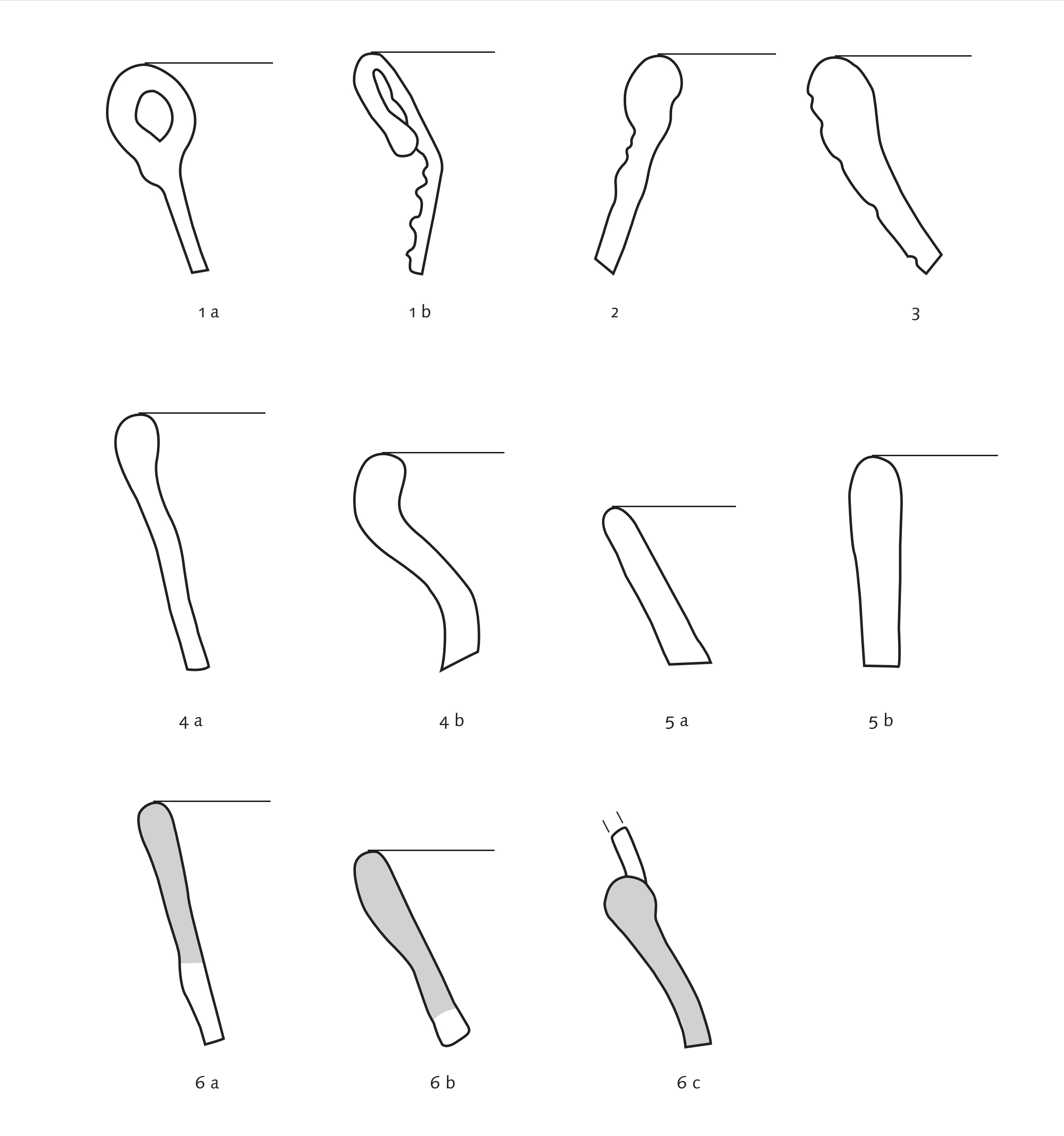
9.2.1 Introductory material description

322 vessel sherds collected from the settlement area at Kaupang are presented in this study. The fragments have a relatively uniform appearance. The ware is predominantly thin, between 1–2 mm in thickness and with finely dispersed bubbles in the matrix. Almost 90% of the sherds are of light blue or green tints, including some nearly colourless fragments (Fig. 9.3). This makes a classification of the material based on the matrix alone difficult. The majority is also without visible decay and is most likely of a durable *low-magnesium soda-lime-silica* composition. This has, with one exception, been confirmed through EPMA and EDX-analyses of a sub-sample. The chemical composition of the glass will be discussed further in Appendix 9.1. The following text will concentrate on the visual characteristics of the glass, and present the elements used to classify the fragments for further analyses.

About one-third (33.8%) of the sherds are decorated (Fig. 9.4). The decorative elements are typical of West European glass production of the Early Middle Ages (further below, 9.2.2). Amongst the most common are marvered or unmarvered applications of bichrome twisted cables (*reticella rods*) and/or trails of glass. These are almost exclusively opaque white or yellow. Some vessels also have secondarily applied, so-called *in calmo* rims in deep blue or green colours. Less common are sherds with mould-blown ribs or bosses. No gold- or tinfoil-decorated vessels or examples of early Islamic cut or enamelled glass have been identified. The high frequency of decoration at Kaupang contrasts with the reduction observed in late 8th- and 9th-century phases at the *Posthus* (Post Office) site in Ribe (average 24.1%, cf. Lund Feveile 2006:201, fig. 4 phases E–H/I).

Rim sherds are particularly useful both to study the range of vessel-forms present and for the quantification of a fragmentary assemblage (see below, 9.2.4 and 9.5.2). Fifty rims have been recorded at Kaupang. All the examples are fire-rounded. Two are of uncertain date (C52519/12250 and C52519/38390). The remaining 48 can be attributed to the Early Middle Ages with relative certainty, although the exact vessel-form is not always identifiable.

The rims have been classified on the basis of the rim direction (i.e. the vessel profile close to the edge), the type of fold (if any), and the type of deco-



ration on or inside the folded rim (if any). Six rim-types have been distinguished and some of these divided into sub-types (Fig. 9.5). It should be pointed out that the rim-types (and sub-types) are meant primarily as a classificational method. They seem to represent individual vessels rather than a typological sequence. There are several intermediary forms, and wall thickness has not been taken into consideration for classification. It is nevertheless possible to associate certain rim-types with particular vessel-forms. Funnel beakers, for example, are associated with Type 4a and 4b and jars with Types 1b and 2. Applied rims (so-called *in calmo* rims: Type 6a–c) are, technically speaking, a decorative application and not a distinct rim-type. However, I have chosen to sub-classify the group according to the three main rim profiles that are found. These variants and their association with individual vessel-forms will be treated in more detail below (9.2.3).

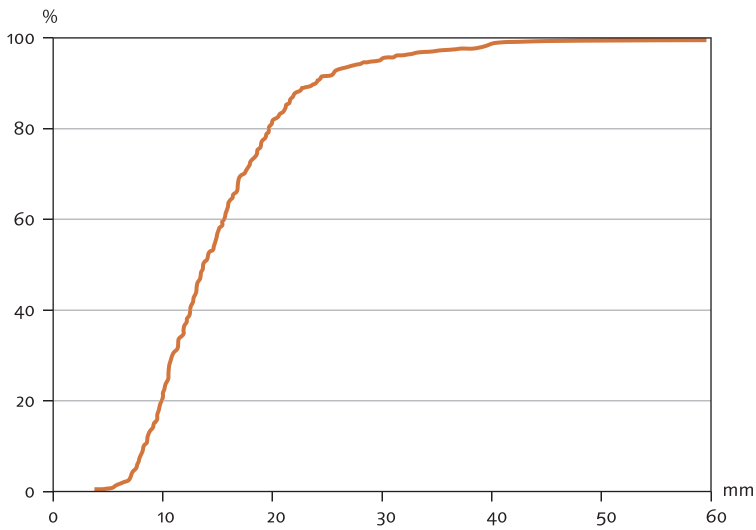
Figure 9.5 *Rim-types present at Kaupang. 1a: External fold, tubular with cavity.* ***1b:*** *External fold, not closed.* ***2:*** *Internal fold, pronounced external lip.* ***3:*** *Internal fold, pronounced internal lip.* ***4a:*** *Slight internal fold.* ***4b:*** *Like 4a, markedly S-shaped.* ***5a:*** *Not folded.* ***5b:*** *Not folded but thickened.* ***6a:*** *In calmo, not folded.* ***6b:*** *In calmo, external lip.* ***6c:*** *In calmo, double. Not to scale. Illustration, Elise Naumann.*

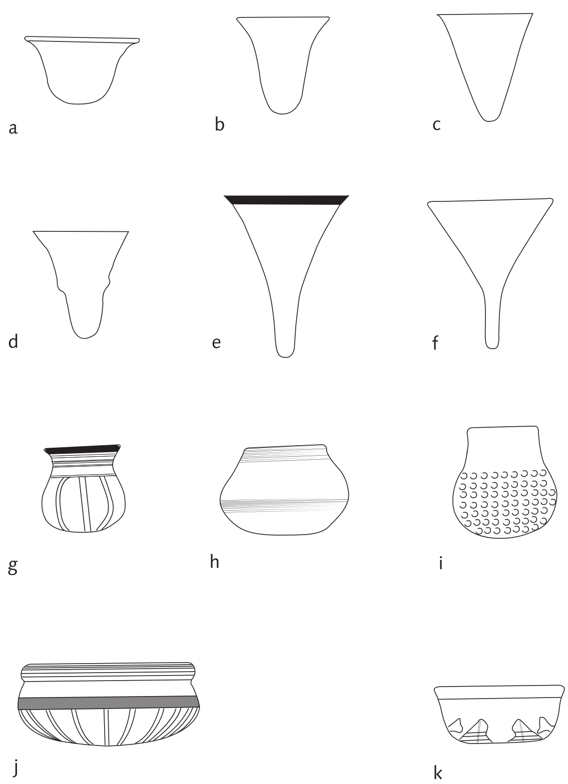
Figure 9.6 *Cumulative frequency diagram illustrating the maximum size of the vessel-fragments from Kaupang (N=322).*

Figure 9.7 *Vessel-forms mentioned in the text:* ***a:*** *Palm cup.* ***b:*** *Tall palm cup.* ***c:*** *Cone beaker.* ***d:*** *Carinated funnel/cone beaker.* ***e:*** *Concave funnel beaker.* ***f:*** *Angular funnel beaker.* ***g–h:*** *Jar- forms.* ***i:*** *Grape beaker.* ***j:*** *Bowl, Valsgärde 6.* ***k:*** *Bowl, York. Illustration, Elise Naumann.*

Context \ Rim-type	1a	1b	2	3	4a	4b	5a	5b	6a	6b	6c	Unclass.	Sum
SP I	1												1
SP II:1					4				1				5
SP II:2				1	2								3
SP III									1				1
SP I-III			2		1				1		1		5
Without SP					2		1						3
Late-med. plough-layer		1			6				2			2	11
Modern ploughsoil	1			1	6	3	2	1	3	2		2	21
Total	2	1	2	2	21	3	3	1	8	2	1	4	50

Table 9.4 *Distribution of rim-types in different contexts at Kaupang.*





Rim diameter is also a useful basis of vessel identification, although the limited size of most fragments has made measurement difficult, and in most cases there is a degree of uncertainty attached to the specified dimensions. According to Matthew Stiff (1996:46–96), who has studied glass from 7th- to 10th-century *wic*-sites, bowls generally have a rim diameter of 13–14 cm, which is well beyond that of tall palm cups/funnel beakers (predominantly 9–12 cm) and other Early-medieval vessel-types. Jars, on the other hand, are slightly or significantly smaller than funnel beakers (< 9 cm). Generally speaking, the diagnostic sherds from Kaupang confirm this pattern. However, the rim diameter of the many identified types of jar varies significantly (5–11 cm), with the maximum well above the range suggested by Stiff.

Another point to note is that the rim-types found in the stratified 9th-century deposits at Kaupang have a relatively homogeneous appearance (Tab. 9.4). The majority are undecorated rims of Type 4a associated with funnel beakers. The second largest group (Type 6a) probably also represents this vessel-form. Material from the later medieval plough-layer and the modern ploughsoil is more varied, perhaps indicating a wider catchment-area for the importation of glass or the presence of a wider range of vessel-forms on the site during the late 9th and early 10th centuries.

Like most settlement assemblages, the Kaupang vessel glass is heavily fragmented (Fig. 9.6). The maximum length of the sherds is typically 10–20 mm. Only 15 sherds exceed 30 mm. This indicates that the level of both trampling and redepositional activity has been high. Although this is not unexpected at a densely populated, multi-phase settlement, it is likely to have had considerable consequences for the artefact distribution and the interpretation of any intra-site activity patterns. These aspects will be explored below (9.2.4–6).

This fragmentation also has implications for

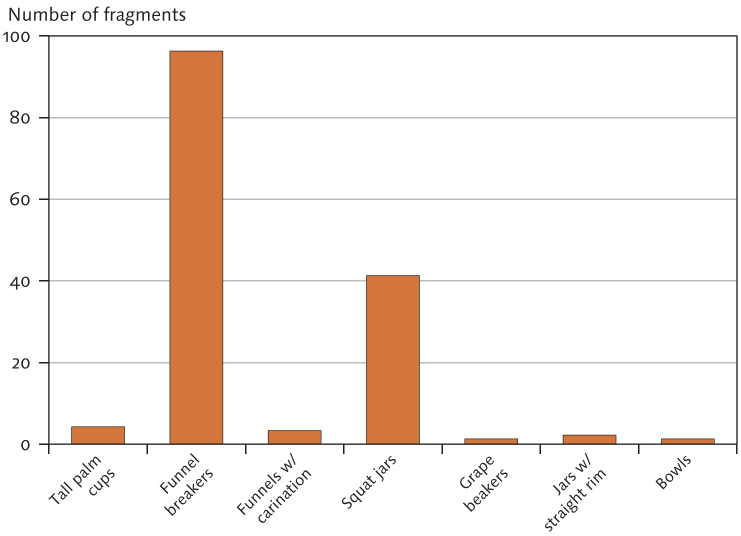


Figure 9.8 *Numbers of identified vessel-fragments at Kaupang (N=148).*

Figure 9.9 *Vessel-fragments from Kaupang decorated with body-coloured trails.* ***a:*** *C52519/11019.* ***b:*** *C52519/16470. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

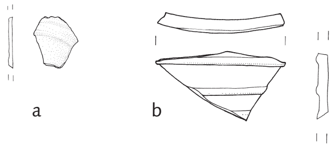


Figure 9.10 *Reticella diagram. Illustration, Elise Naumann, after Evison 1988a:fig. 12.*

the identification of the vessel-types present. Most Early-medieval glass vessels were produced by free blowing and will naturally vary in colour and shape, and in how decoration was applied. This makes it difficult to assign small fragments to particular vessel-types with certainty. Nevertheless, 148 of the sherds (46.0%) have been positively identified. The majority have been classified from their individual attributes. The remaining identifications are made from a combination of matrix and decorative characteristics, chemical and spatial analyses. Not unexpectedly, the majority of identifiable vessel-fragments belong to vessel-types typical of the early Viking Period; cone-/funnel-shaped beakers, and globular jars (Figs. 9.7–8). A small number of more unusual vessel-forms – bowls, grape beakers, tall palm cups, and a carinated funnel beaker – have also been observed.

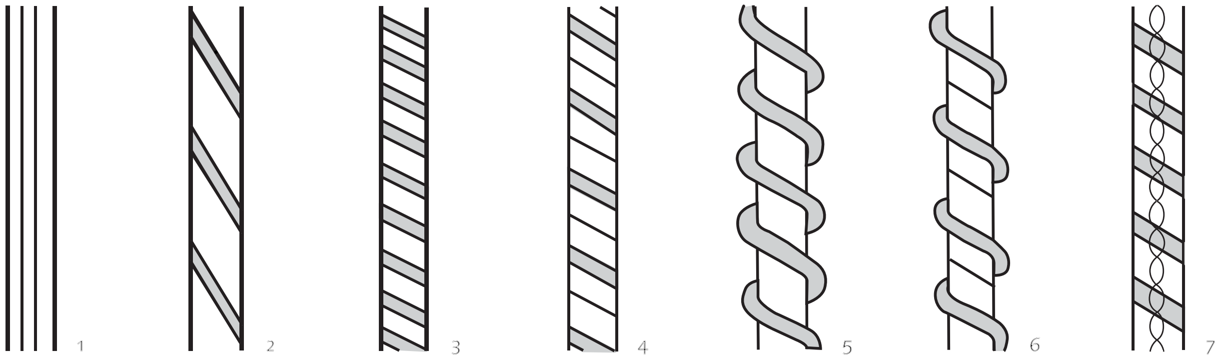
Vessel-forms that are easily identified through shape or decoration, and vessels particularly prone to breakage, are likely to be overrepresented by a sherd count. This may have amplified the preponderance of funnel beaker- and squat jar-fragments on the site, and similarly rendered bowl-forms, which are less easily identified, "invisible" (on vessel quantification, see further below, 9.2.4). Bearing this in mind, the number of identified fragments nevertheless confirms that a standardisation took pace in north-western Europe during the 8th and 9th centuries, in respect of both vessel-forms and decoration (e.g. Hunter and Heyworth 1998:58; Sablerolles 1999:242–3; Stiff 2001:45–6). The unidentified vessel-fragments from Kaupang also show generally similar matrix characteristics and decorative elements. Not only are they likely to derive from similar vessel-types, they also indicate that a relatively small number of complete vessels were present on the site compared to the number of individual fragments. This hypothesis is supported through both sherd links and contextual analyses (below, 9.2.5–6).

A narrow dating of the individual vessel-fragments is not usually possible. Typo-chronological studies depend too much on an unrepresentative burial record to be reliable (Appendix 9.2; Périn 1989:125–7; Näsman 1990:90–4; Evison 2000:78–9 and 91), and the dating of the preserved stratigraphic sequence at Kaupang (AD 800–840/50) is by far the most precise guideline available. Although the finds from the stratified early 9th-century deposits broadly support the chronological framework established by the burial record, the sub-sample also includes vessel-types normally dated to the late 8th century. These inconsistencies will be discussed in due course (below, 9.2.3 and 9.4.1), but in my view confirm that the established typo-chronological framework is not fully representative of the production and circulation of glass vessels.

This problem becomes particularly troublesome when the question of vessel circulation at Kaupang in the late 9th and early 10th centuries is considered (below, 9.2.7) – a period from which there is no preserved stratigraphic sequence. The unique presence of some jar-types in the medieval and modern ploughsoil is a strong indication that these were deposited after the middle of the 9th century, but because there is also some early 9th-century material mixed into the ploughsoil (Pedersen and Pilø 2007:186), one cannot infer this with absolute certainty. At the same time, there are isolated sherds with decorative elements paralleled in 10th- or even early 11th-century contexts. It nevertheless remains an open issue whether these possible datings could be used to argue for some late 10th-century settlement activity at Kaupang.

9.2.2 Decorative elements
Applied trails

The most frequent decorative element on the Kaupang glass is thin *trails* of glass, loosely spun around the body or marvered into the vessel matrix



(N=74, 23.3% of the total assemblage). Trailing is found on all the most typical Viking-period vessel-forms (jars, funnel beakers and bowls). It can be applied vertically, horizontally, or in arcades across the body and rim. Nine fragments from Kaupang combine trailing with reticella decoration (below).

The trails are almost exclusively made of white (N=54) or yellow (N=16) opaque glass that creates a contrast to the vessel matrix. Four sherds, probably from a single vessel, combine white and yellow trails (SF 10: see below, 9.2.3). Yellow trails are by far the most dominant form in Continental and British 8th-century assemblages (Hunter 1980:70; Sablerolles 1999:231–2). They almost exclude the alternatives in phases B–E (c. AD 705–790) at the *Posthus* site, while the frequency of white decoration appears to increases toward the late 8th and early 9th century (Lund Feveile 2006:218–19, fig. 22). This trend accelerates in the largely 9th-century assemblage from Kaupang. Also amongst vessels decorated with applied trails *and* reticella cables (below) there is a similar shift of prominence from yellow to white. Looking at the data from Ribe (Lund Feveile 2006:figs.17 and 22) and Kaupang, it is thus clear that the equation often made in the past between vessels decorated with yellow trails and reticella-decorated vessels (e.g. Hunter 1980:70; Näsman 1986:78; Hunter and Heyworth 1998:57) does not apply to 9th-century Scandinavia.

The present assemblage also includes two fragments decorated with body-coloured trails; a light yellow-green sherd with thin arcaded trails (C52519/11019) and a dull, very light green sherd with slightly thicker horizontal trails (C52519/16470) (Figs. 9.9.a–b). The former is probably from a tall palm cup or funnel beaker (as Holmqvist 1964:figs. 120–2). The latter is not diagnostic, but may be from an area close to the rim of a bag- or claw-beaker. Body-coloured trails are generally rare on Viking-period vessels. This suggests that the Kaupang examples may derive from earlier vessel-types (see further below, 9.4.1). Blindheim's settlement assemblage also includes two very thin sherds with thin trails characteristic of Merovingian period claw-beakers (personal observation, KHM).

Reticella decoration

Reticella rods or, more accurately, bichrome twisted cables are found on 26 sherds (6.1% of the total assemblage). The cables are invariably created by turning thin opaque glass trails around a core of glass to create a network effect (Fig. 9.10; Evison 1988a:240–3; Lund Feveile 2006:215–18). The colour of the core is nearly always the same as the vessel wall. At Kaupang, only sherds from two vessels (SF 2 and 3) deviate from this: SF 3 has white-on-colourless reticella on a red marbled and flashed vessel, while SF 2 combines both streaked and colourless reticella cores on a red streaked vessel wall (occasional examples are also known from Groß Strömkendorf: Pöche 2005:30, Katalog, and Ribe: Lund Feveile 2006:215–16). The rods on eleven sherds have central threads in addition to spun trails (Fig. 9.10.7). On C52516/3869 this is constituted of a twisted dark and opaque white trail. It should be noted that a vessel can combine cables with a variable level of twist, and also rods with different numbers of threads or rods with or without central threads (C52519/9997 and /21703 provide examples of both). The character of the reticella rods therefore cannot be used directly to distinguish between cables from different vessels in an assemblage.

Rods with white spun threads dominate the assemblage (N=16); occasionally yellow threads (N=4) or a combination of yellow and white threads (N=4) are seen. One sherd (C52167/1962) has a reticella cable formed by twisting three blue-green and four yellow threads around a very light yellow-green core. Most of the yellow reticella rods and the rods with white and yellow trails are heavily melted into the vessel wall. In one instance (C52264/483) the yellow colour has "bled" on to the vessel wall. Näsman (1986:77–9) has suggested that this is caused by excessive heating, but it may also be the effect of turning coloured threads around a cooled core (Fig. 9.10.5–6; Evison 1988a:243, 2000:85; cf. Harden 1976:233).

At Kaupang, reticella decoration is primarily associated with squat jars but is also occasionally found on funnel beakers (e.g. C52264/483 and C52516/3188). No less than ten fragments derive from

Context	Colour				Vessel-form		
	Blue	Green-blue	Blue-green	Green	Funnel	Jar	Unclass.
SP I							
SP II:1	1				1		
SP II:2							
SP III		1			1		
SP I–III	1	1			1		1
Without SP							
Late-medieval plough-layer		3			2		1
Modern ploughsoil	2	2	1	1	4	2	
Total	4	7	1	1	9	2	2

Table 9.5 *Vessel-fragments with in calmo-decorated rims.*

two or three red streaked or marbled jars from the MRE trenches (SF 2 and 3). Except for the two funnel beaker sherds (above) and the marbled jar (SF 3), for which the data are inconclusive, reticella decoration always appears in combination with trailing, although not every sherd from a vessel need display both elements.

In calmo decoration

Some funnel beakers and jars are also decorated with secondarily applied rims in a deep contrasting colour (known as *in calmo*). The 13 fragments recorded at Kaupang (4.0% of the total assemblage) fall into distinct dark green or blue colours (Tab. 9.5). C52516/2581 should possibly also be considered an applied rim. The fragment is morphologically similar to one of the blue examples (C52519/12022), but is too small to be identified with certainty. A few further dark blue rim-fragments (Type 4b) are most likely parts of deeply coloured funnel beakers rather than applied rims. From Hedeby, *in calmo* applications are also known in yellow-brown (Steppuhn 1998:pl. 217), and a small jar from Birka grave 644 has a deep violet rim (Arbman 1940–3:pl. 189.4). These colours have not been found at Kaupang. Where the vessel section is preserved below the rim, the glass is typically of nearly colourless high-quality fabric.

All the extant rim sections have been separately blown and shaped, and applied to a waiting vessel after it had been formed and transferred from the blow-pipe on to the pontil (Stiff 1996:38). No examples of the *Überfang* or *flashing* technique, where the coloured rim is created by dipping the vessel edge in a coloured batch, identified by Greta Arwidsson on some vessels from Birka (Arwidsson 1984:208 and note; cf. Pöche 2005:37), have been recorded. The edges of the vessels appear to have been carefully folded and/or rounded, and the rim section then placed directly on top of or slightly inside it. Finally, the new rim could be worked and fire-rounded.

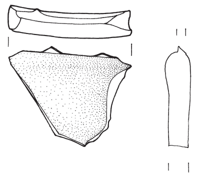
It is possible to sub-divide the applied rims according to their vessel profile (Fig. 9.5.6a–c). Rims of Type 6a, with a high rim section and straight profile, can be related to funnel beakers (e.g. Stjernquist 1999:fig. 11; Isings 1980:figs. 153–4). Many jars have shorter rims with a more pronounced lip (Type 6b) set at an angle to the vessel wall, but this is not a diagnostic element (e.g. Baumgartner and Krueger 1988:nos. 15, 17). In cases where the fragments are broken just below the applied rim it is not always possible to determine the vessel profile with certainty. A *double* applied rim (Type 6c), where a section of colourless glass has been applied on top of a folded smoothed band of deep blue glass (C52519/9661) (Fig. 9.11), has few published parallels (e.g. Dorestad: Stiff 1996:F/142 and F/47; Hedeby: Stiff 1996:G/4; and Hamwic: Hunter and Heyworth 1998:fig. 6.31/564 and especially 169/709). Unfortunately little of the profile is preserved, and it is difficult to judge the vessel-form. The Hamwic parallels are, however, believed both to be from tall palm cups or funnel beakers.

The *in calmo* rims are a relatively late development within Early-medieval glass production. The technique is largely absent in assemblages dominated by 8th-century material (Stiff 1996:310, fig. 52; Hunter and Heyworth 1998:8–12; Pöche 2005:37), and only appears in phases G–I (800–850) of the *Posthus* site (Lund Feveile 2006:fig. 7). At Kaupang, examples are found in SP II and III of the MRE trenches (c. 805/10–900) as well as in the later medieval and modern ploughsoils (Tab. 9.5; see also below, 9.2.3, 9.2.5 and 9.2.7).

Mould-blowing

The assemblage also comprises a small number of sherds with mould-blown ribs or bosses. These are created by inflating the gather into a mould, leaving a three-dimensional structure to the vessel wall. In most cases the glassblower would continue inflation

Figure 9.11 *C52519/9661 is part of a double applied rim, probably from a funnel beaker. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*



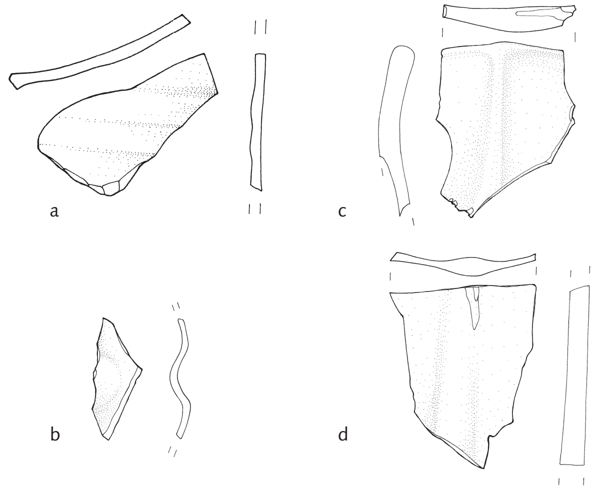


Figure 9.12 *Vessel-fragments with mould-blown decoration.* ***a:*** *C52519/20255.* ***b:*** *C52519/38381.* ***c:*** *C52519/12250.* ***d:*** *C52519/41092. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

even after the mould was removed (optic blowing). This caused a softening of the relief (Stiff 1996:35–7). Mould-blowing was practised throughout the Early Middle Ages but only infrequently during the Viking Age. The technique would later experience a renaissance in the High Middle Ages and Early Modern Period, when it is seen on several vessel-types. Some examples of this have been identified at Huseby (Gaut 2004) and in the modern ploughsoil at Kaupang.

The mould-blown Viking-period glass from Kaupang represents only small fragments of the original vessels. C52519/20255 is a very light blue body-fragment with four parallel optic-blown ribs, probably vertically positioned on the vessel wall (Fig. 9.12.a). Similar decoration is known from tall palm cups and funnel beakers (Ypey 1964:figs. 40.2–3 and 6; Stiff 1996:50–64; Lund Feveile 2006:219, 227, fig. 38.4). The sherd that is the only such stratified example from Kaupang was recovered from SP II:1. Other vessel-fragments with optic blown ribs have been observed in the ploughsoil assemblage, from Blindheim's settlement excavations (MO65/ss and MO60/5f: Stiff 1996:295–6), and at Huseby (Gaut 2004:C52518/1495).

C52519/38381, a small fragment of medium green-yellow glass with high gloss and clarity (Fig. 9.12.b), is decorated with one complete and part of a second mould-blown boss similar to the *grape beaker* from Birka grave 539 (Baumgartner and Krueger 1988:no. 31). Another possible grape beaker-fragment has been identified in Blindheim's settlement assemblage (Stiff 1996:295). It is likely that the thin fabric combined with the shape of the bosses causes vessel-fragments to break easily, so that they are rarely recorded. With the exception of the Birka find, sherds have only positively been identified at Paderborn, Hedeby (Baumgartner and Krueger 1988:nos. 31–33), and Brandon in Suffolk (Evison 2000:80, fig. 14a). Matthew Stiff (1996) has also pointed to possible vessel-fragments in Ipswich (B/151, B/155 and B/164), Hamwic (D/194) and Ribe (H/73). The extant Kaupang specimen is from a disturbed deposit (the modern ploughsoil), but the vessel-type is documented in the AD 778 destruction layer at Paderborn (Winkelmann 1977). The find-combination in Birka grave 539 makes it likely that this vessel was deposited around AD 850 or a little later (Arbman 1937:54; cf. Kyhlberg 1980:70–3).

Finally, two light green-yellow sherds decorated with an optic blown vertical rib should be mentioned (C52519/12250 and /41092: Figs. 9.12c–d). The vessel-form is uncertain, but it may be a cylindrical beaker or a jar with a simple fire-rounded, constricted rim. Similar decoration is found on vessels from the Middle to Late Viking Period, for example in Dorestad (WD320: personal observation in the Rijksmuseum van Oudheden, Leiden; Roes 1965:pl. XVII.127), Borg (Ts.8336fn: vessel G2: Henderson and Holand 1992:pl. 3c), and Broa, Gotland (Arbman 1937:50, fig. 6. See Henderson and Holand 1992:52–3 and refs.). The Kaupang fragments are, however, both from the modern ploughsoil, and they *could* also derive from later medieval vessel-types (e.g. Tyson 2000:fig. 16.g196; Schlosser 1977:fig. 119).

Red streaked and marbled glass

Two characteristic colour effects seen in a number of fragments from Kaupang is red streaking and flashed layers of red marbled glass (Fig. 9.62.u-v, ao-ap, bj-bo). Flashing is caused by dipping the gather, or semi-inflated vessel, in a different coloured batch, creating a layered appearance when the glass is studied in cross-section. One might therefore consider this a deliberate decorative technique. Streaking could be either an intentional or unintentional effect (Maul 2002:98–100). Although red streaked or flashed vessels are found occasionally throughout the Early Middle Ages the use of these techniques is clearly concentrated in the late 7th–

9th centuries (Evison 1990:217 and 222; Maul 2002:98 and 100), and it is often associated with Carolingian glass production.

In the present Kaupang assemblage, eleven fragments (3.4% of the total assemblage) are flashed with marbled opaque glass and sixteen (5.0%) have a streaked matrix. Most of these sherds derive from two or three squat jars from the MRE trenches (SF 2 and 3), but also sherds from a green jar (SF 7) and two other separate light blue fragments have red/dark streaks in the metal. The colour of the streaking/marbling (red – occasionally brown or black) is most likely caused by reduction of Cu^{2+} ions in the matrix and the subsequent formation of CuO crystals through heat treatment or "striking" (Henderson 2000:32–4). Compositional analyses of three fragments from Kaupang have shown that this process was helped by the presence of 1.6–2.8% iron oxides in the glass (Appendix 9.1, samples KAU29, 42 and 47). The streaked appearance can be caused through stopping the striking process midway, or possibly from uneven dispersal of the colouring agent in the batch (Evison 1990:217–18 and 222–3; Maul 2002:99). The flashed fragments reveal not only several intermediary layers of translucent blue-green and opaque red glass. Most of the red layers also have a marbled effect. The cause of this has been debated, but finds of crucibles with marbled red and black and translucent green glass seem to indicate that the effect was deliberate and present before the gather was dipped (Evison 1990:222–3). Evison has argued that it was achieved through incomplete mixing of the batch after opaque red tesserae had been added to it. This latter effect is clearly seen on one of the Kaupang fragments (C52264/581) where translucent green and opaque red glass appear to have been mixed before being gathered (Fig. 9.62.ao).

9.2.3 Vessel-types and individual sherds

This part of the text will present in detail the range of vessel-forms and vessel-types present at Kaupang, and also some unidentified fragments with distinctive elements of decoration. The focus will be on identification, the presentation of known parallels, and, as far as possible, dating of different vessel-types. A short assessment will also be given of the vessels' distribution and use. The fragments' spatial distribution and relationship to excavated structures at Kaupang is discussed subsequently (below, 9.2.5–6), and is only referred to here when relevant to the dating of the vessels.

Tall palm cups/funnel beakers

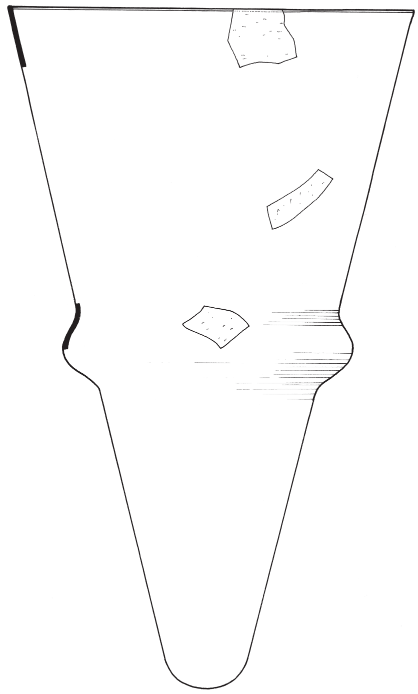
Tall palm cups and funnel beakers are high concave vessels with a narrow base, evolved from the Merovingian palm cup (German: *Tummler*) (Fig. 9.7.a–b; Ypey 1964:144–7, fig. 40; Hunter and Heyworth 1998:4–14; Lund Feveile 2006:209–11). The rim diameter of *tall palm cups* commonly measures 10–12 cm, and the vessel height exceeds the rim diameter. The vessel profile is typically out-splayed, with a tubular (Type 1a) or simple folded rim (Type 3 or 4a). The shape of the fully developed *funnel beaker* is even higher and slimmer (complete examples from Birka measure 11–17 cm), with a further constricted base forming a thin hollow tube. The overall vessel profile may, however, vary considerably: from near conical or only slightly concave to funnels with tall, thin base-segments and distinctly splayed upper halves (Fig. 9.7.e–f). The rim is normally 9–12 cm in diameter and always made from a simple fold (Type 3 or 4a), with some vessels developing a characteristic S-shape (Type 4b). Separate applied rims (Type 6a and c) also occur (Steppuhn 1998:59–60).

Funnel beakers are generally considered to have entirely replaced tall palm cups by the early Viking Age (Hunter and Heyworth 1998:14; Pöche 2005:24). To sustain a clear chronological and typological distinction is difficult, however. Based on the large assemblage of 8th- and 9th-century glass from Hamwic, John Hunter and Michael Heyworth (Hunter 1980:68–70; Hunter and Heyworth 1998:14) sought to outline a typo-chronological scheme for the rims of these vessel-forms, from tubular rims with an external fold (Type 1a) to simple internal folds (Types 3 and 4). Other scholars (e.g. Näsman 1986:74; Stiff 1996:51–2) have tried to use this framework to date individual vessel-fragments. Closer scrutiny of the Hamwic material together with finds from the recently published *Posthus* site (Lund Feveile 2006), however, indicate significant chronological overlaps between the different rim-forms. Hunter and Heyworth (1998:56) themselves acknowledge that their chronology is at odds with the dating framework obtained from Scandinavian furnished burials, and the presence at Kaupang of a Type 1a rim calls their chronological framework further into question.

Although the developments pointed out by Hunter and Heyworth may represent general trends, it is not possible to use them as diagnostic parameters with which to date or identify individual vessels. More likely, the detailed execution of the rims could vary from artisan to artisan and vessel to vessel. It is also possible that differences are an expression of different craft traditions associated with individual glass manufactories.

Several "transitional" forms between palm cups and funnel beakers occur in the early 9th-century deposits at Kaupang. There are indications that some of the vessels had a relatively conical profile, and that beakers of this shape were more widespread than has previously been recognised. Because it is difficult to distinguish between fragments of tall palm cups, funnel beakers and cone beakers, and these vessel-forms are typologically and function-

Figure 9.13 *Reconstruction of funnel beaker with carination (SF 16). Height and rim diametre unknown. (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*



ally closely related (cf. Ypey 1964:146; below, 9.5.3), the vessel-forms will be treated together here.

Of 103 individual identified tall palm cup/funnel beaker fragments (69.6% of all identified sherds) five show features that clearly are *typologically "early"*. C52519/22789 is a tubular rim-fragment, likely to be from a light green-blue tall palm cup or cone beaker with a rim diameter of 11–12 cm. The rim is rolled outwards to create a circular cavity (Type 1a). Three other light green-blue sherds (C52516/111 and /3586, and C52519/12478) are base-fragments with a thinner fabric and a wider base diameter than normally found on developed funnel beakers. Finally, C52519/27596 (SF 16; with two contextually associated but not diagnostic sherds C52519/18573 and 24595) *may* be from a tall palm cup/funnel beaker with horizontal carination on the lower wall of the vessel (Fig. 9.13). The latter fragment resembles a funnel beaker in every other respect. Vessels of this type have recently been published from Groß Strömkendorf (Pöche 2005:28–9, pl. 5.12–14). On the *Posthus* site fragments are found throughout phases B–G (c. AD 705–820) (Lund Feveile 2006:fig. 39), and finds from Birka, Helgö, Paviken and Frisia can also be dated to the 8th and early 9th centuries (Lund Feveile 2006:221–2 and 235, fig. 35, with refs.; cf. Isings 1980:225–6, fig. 152). The distribution is probably wider but not yet fully charted (e.g. Hunter and Heyworth 1998:fig. 13, nos. 24/524, 26/824 and 169/1063).

The stratified sherds with tall palm cup/cone beaker characteristics are from SP I and early SP II contexts, from which there are generally few finds of glass (below, 9.2.5). The finds suggest that tall palm cups and beakers with carination continued to circulate into the 9th century (cf. Stiff 2001:46). This is supported by a beaker from Pingjum, Frisia, dated by Ypey to the late 8th or early 9th century (Ypey 1964:146–7, fig. 40.11), and manuscript illuminations (e.g. Steinhausen 1939:pls. 9.3 and 10.3).

Alternatively, it is possible that an independent typological development resulted in the evolution of cone beakers with rim and base attributes similar to the earlier tall palm cups (Fig. 9.7.c). Two cone beakers with such attributes have recently come to light in Dorestad, De Geer (personal observation, ROB Amersfoort 2005). With regard to their height and width, the vessels are comparable to funnel beakers, but the rim profiles are less splayed and the bases are of thinner fabric, immediately starting to expand toward the rim. One of the vessels is decorated with marvered white festoons, similar to fragments from at least two vessels from Kaupang (SF 4 and 5). The finds from De Geer are unpublished, but may be as late as the mid-9th century.

Most of the remaining fragments in this group are likely to be from developed *funnel beakers,* although it is not always possible to distinguish them positively from the transitional forms described above. Most identified rims are of a simple in-folded type (Type 4a), occasionally with a distinct S-shaped profile (Type 4b) or a pronounced internal lip (Type 3). Vessels with applied rims (Type 6a) have also been observed. Equally diagnostic is the curvature and orientation of bubbles in the matrix near the base and where the body begins to flare. C52519/17215 is a light green base-fragment, preserving about 4 cm of the base and lower vessel wall. The fragment is decorated with two vertical white trails. Several other fragments must be positioned close to the base of cone or funnel-shaped beakers (C52519/12247, /10497 and/ 38325, C52517/1227, C52516/2574, /948, /6384 and /6383, and C52264/940539 and /940487). The assemblage from Blindheim's settlement exca-

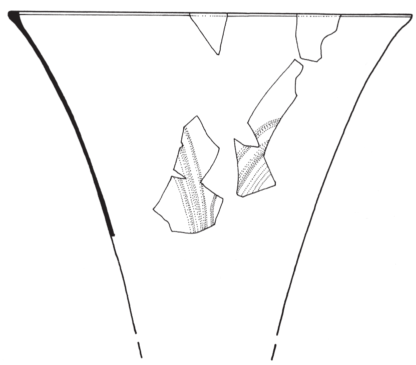
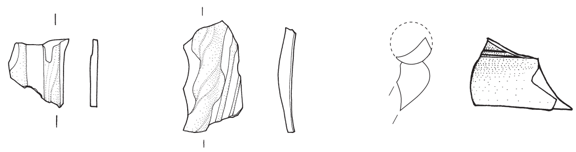


Figure 9.14 *Reconstruction of funnel-beaker with white marvered trails (SF 5). Height and rim diametre unknown. (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 9.15 *Reticella-decorated funnel beakers.* ***a:*** *C52264/5 (496).* ***b:*** *C52264/483.* ***c:*** *C52516/3188. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*



vations also includes a number of funnel bases (personal observation, KHM; Hougen, n.d.). The relative small number of identified bases in Skre's assemblage is nevertheless surprising considering their solidity and distinct shape. A similar deficiency of funnel bases is also noted in the assemblages from Hamwic, Ribe and Groß Strömkendorf (Hunter and Heyworth 1998:14; Pöche 2005:28). Base-fragments, however, will naturally be under-represented relative to wall and rim sherds if the assemblage is quantified by sherd count because the thick fabric and small surface to mass ratio inhibits fragmentation. The large and chunky fragment size also makes it likely that they could be removed and discarded separately from other domestic refuse (below, 9.2.6). Another possible explanation is that many vessels had a more conical profile, in which case the bases would be thinner and more prone to fragmentation.

Although tall palm cups/funnel beakers are mostly undecorated, fragments decorated with mould-blown patterns, reticella cables, trails, and *in calmo* applications have been observed. Many sherds can only be attributed to Sherd Families, and so identified as funnel beakers, through their decoration. A large proportion of the undiagnostic, undecorated light blue and green sherds from the settlement area are also likely to be from tall palm cups/funnel beakers. The percentage of decorated sherds that has been recorded (N=28, 27.2% of the funnel beaker-fragments) is therefore likely to be artificially high.

The most frequently recorded decoration is *marvered white trailing*. C52519/10021 and /17215 (SF 9) indicate that the trails could cover the entire vessel body. Another piece (C52519/21045) is decorated with five thin horizontal trails positioned in a zone up to the rim. The remaining fragments belong to a group of at least two vessels (SF 4 and 5), that is decorated with marvered white festoons. The closest parallel to this is seen on a cone beaker from Dorestad, De Geer. One possible tall palm cup-fragment (C52519/20923) is decorated with a thick horizontal yellow trail.

Other funnel beakers have applied *in calmo* rims in deep blue or green-blue glass (e.g. C52519/12022, /9441, /21074 and /22663, C52516/2586 and /2705, and C52003/940056; see also Grave Ka. 305, Appendix 9.2). The majority of these have a straight rim profile, with a smoothed fold (Type 6a), and the coloured application is relatively deep; normally 10–12 mm (with one outlier at 8 mm) (Fig. 9.62.aw-ba). A double applied rim (Type 6c) is also recorded (C52519/9661; cf. Hunter and Heyworth 1998:12). Three distinct deep blue S-shaped rim-fragments of Type 4b (C52517/2421, C52519/29003, and C52264/803) are unlikely to represent applied rims although they most probably are from funnel beakers. Funnel beakers with applied rims appear frequently in northern European find contexts (e.g. Trelleborg: Stjernquist 1999:fig. 11; Wijnaldum: Sablerolles 1999:fig. 1, no. 26; Dorestad: Isings 1980:fig. 153; Helgö: Holmqvist 1964:figs. 117–19; Birka: Arbman 1940–3:pls. 189–90 and 192; Hedeby: Steppuhn 1998; Groß Strömkendorf: Pöche 2005:pl. 10.8; Ribe: Lund Feveile 2006:fig. 6c). Similar sherds also occur at Hamwic (Hunter and Heyworth 1998:pl. 4, 36/5), but applied rim sections appear not to be a frequently used decorative technique there.

A small number of funnel beakers are decorated with *reticella cables*. C52264/5 (496) is from the lower part of a funnel beaker, decorated with vertical white and yellow on self-coloured reticella (Fig. 9.15.a). A sherd decorated in the similar way (D64/4) was also found during Blindheim's settlement excavation (Stiff 1996:296). Comparable decoration is documented at Hamwic, Dorestad, Ribe and Helgö, amongst other places (Lund Feveile 2006:223, fig. 27, with refs.).

A surface find of another sherd of thin glass (C52264/483: Fig. 9.15.b) decorated with a looped or arcaded yellow reticella cable *may* also be from a funnel beaker (e.g. Hamwic: Baumgartner and Krueger 1988:no. 21) although the vessel shape itself is undiagnostic. Similar decorative features are also seen on bowls (e.g. Borg: Holand 2003a:214, fig. 3; Portchester Castle: Harden 1976:fig. 145.2–3).

C52516/3188 is remarkable because remnants of a very slightly twisted white on self-coloured reticella cable can be seen on top of the rim (Fig. 9.15.c). A similar sherd from Blindheim's settlement excavations (MO59/å) has been identified by Stiff as a funnel beaker with a rim diameter of about 10 cm (Stiff 1996:295). Funnel beakers with reticella-decorated rims are extremely rare outside Hamwic, where 8.6% of all rim-fragments are decorated in this way. The colour of the reticella canes is always white on body-coloured. Identical sherds have also been excavated at St.-Denis, France (Evison 1989:140; Foy and Sennequier 1989:nos. 60e–f).[3] Hunter has argued (1980:71) that reticella-decorated rims are exclusive to a glass manufactory in the Hamwic/Winchester region, and Stiff has suggested (1996:309–10) that the examples from Kaupang could have reached the site by way of trade between Anglo-Saxon and Scandinavian areas during the early Viking Age. Although the vessel-type is likely to represent the output of one, or a small number of production sites, Hunter's suggested provenance is unproven, and there are few other indications of communication between Kaupang and the Hamwic area. The finds from St.-Denis, and wall sherds with untwisted reticella decoration from Liège (Evison 1988b:242–3, fig. 10), could suggest that one should look for a common origin for the Kaupang and Hamwic glass in Neustria, a region with known contacts with both sites (e.g. Hodges 1981:90–4; Andrews 1997:253–5; Stylegar 2007:84; Pilø, this vol. Ch. 10:294–5; Wamers, this vol. Ch. 4:76–9). Some of the raw glass and glass linen-smoothers from Kaupang are also likely to have originated in this area (below, 9.3.2, 9.4.1 and Appendix 9.1).

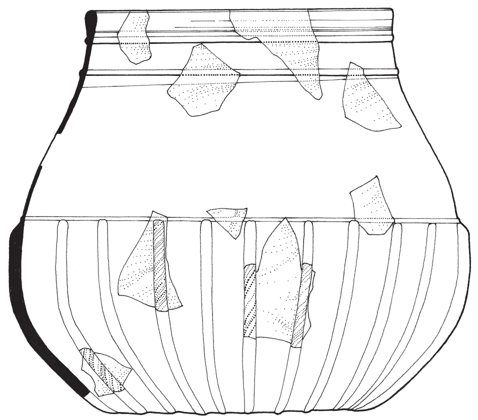
The funnel beaker was probably the most extensively used vessel-type of the Viking-period, with a wide distribution on trading settlements, and rural sites of consumption (Lund Feveile 2006:figs. 34–5, with refs.). Most scholars assume that the vessel-type was produced in the Rhine area (e.g. Arbman 1937:28–36; Sablerolles 1999:239; cf. Hunter and Heyworth 1998:56–61; Näsman 2000:40–2). There is, however, as for most other European glass production of the period, little positive evidence to support this (Haevernick 1972:216–7; Steppuhn 2001). The known distribution largely mirrors site visibility and archaeological activity, and cannot be used to address the question of production directly (Näsman 1986:101, 2000:37–43). The funnel beaker is a relatively simple vessel-form, and could be produced in several glass manufactories. Analyses of excavated examples from northern Europe reveal several compositional groups (e.g. Sanderson et al. 1984:62–6, tab.7; Wedepohl 2003:84–8, tabs. 19–22), but so far it has not been possible to tie these clusters to individual production sites. A complicating factor is that secondary workshops could receive their raw glass from a series of separate glass-making sites and also mix the compositions further, thereby blurring any compositional patterns (Wedepohl 2003:94–5; Freestone et al., in press). It should be noted in this connexion that funnel beakers made of potassium-rich glass, known from Birka (Arbman 1940–3:pl. 191.2), Hedeby (Steppuhn 1998:pl. 10) and Paderborn (Stiegemann and Wemhoff 1999:no. III.67), have not been identified at Kaupang.

In Scandinavia, both tall palm cups and developed funnel beakers are attested on trading sites, while funnel beakers predominate in grave finds and at rural and fortified settlements. In the Birka cemeteries funnel beakers are the most frequent vessel-form during the 9th and early 10th centuries (Arbman 1937:73; Arwidsson 1984:tab. 24.1) and two 9th-century graves from Kaupang also contain such fragments (Ka. 304 and Ka. 305: see Appendix 9.2). From the Kaupang settlement area, funnel beakers occur throughout the period of occupation, and represent the majority of identified vessel-fragments. It was most probably the standard (wine) drinking glass of the Carolingian Period (Ellmers 1965; Gaut 2007:35; below, 9.5.3). This is also reflected in contemporary manuscript illuminations (Steinhausen 1939:pls. 9–10). It should nevertheless be noted that similarly shaped vessels were used as lamps in other parts of Europe and the Mediterranean world: suspended or placed on iron stands or racks (Gentili 1988:no. 268; Olcay 2001; Lund Feveile 2006:211, fig. 12b). Although there are no indications of such use at Kaupang, the possibility cannot be ruled out.

Jars

Jars comprise a range of closed vessel forms with a squat globular body and a flattened or kicked base (Foy and Sennequier 1989:nos. 61–4; Stiff 1996:68–81; Evison 2000:figs. 3–4; Lund Feveile 2006:212–4). The majority of complete vessels appear to have a constricted neck and a slightly flared rim that forms a typical S-shaped profile (Fig. 9.7.g). Other examples have rims that taper off directly from the body (Fig. 9.7.h). Two vessels from Birka grave 739 and 750 have a markedly straighter neck/rim profile (Arbman 1940–3:pl. 193.2–3). A third jar type is exemplified by a small, almost egg-shaped vessel from Birka grave

3 Two fragments from Groß Strömkendorf (Pöche 2005, Inv.-Nr. 98/125/820.5a; Inv.-Nr. 98/125/-1439a) and one from Ribe (x501.3: Lund Feveile 2006, fig. 6b) have reticella cables attached to the outside, below the apex of the rim, rather than on top of it.



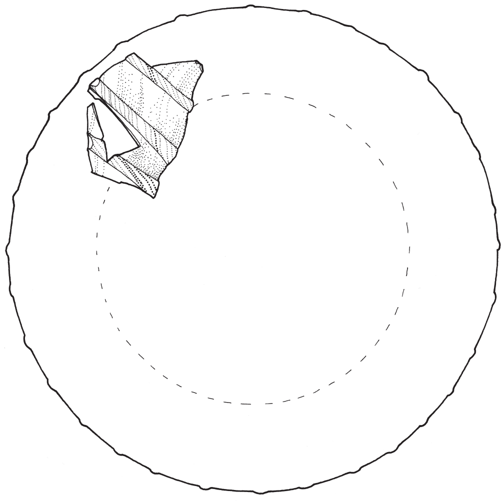


Figure 9.16 *Reconstruction of reticella-decorated jar (SF 2). Rim diameter 8–9 cm. Height unknown. (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 9.17 *Reconstruction of reticella-decorated jar (SF 3). Height and rim shape unknown. (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

644 (Arbman 1940–3:pl. 189.4), with pronounced "shoulders" and a constricted *in calmo* rim. The rims of jars are often relatively thick, with an open external fold (Type 1b) or an internal fold with a pronounced external lip (Type 2). Applied *in calmo* rims (Type 6b) are also known. The rim zone (and body) of the vessels are often decorated with horizontal trailing in combination with vertical reticella rods, while marvered, combed and feathered trailing or vertical unmarvered trailing are rarer. Grape beakers (Fig. 9.7.i) – although strictly speaking a type of jar – are discussed above (9.2.2) with other mouldblown vessel-fragments.

Forty-four sherds from Kaupang have been identified as jars on the basis of their morphology, or by association with diagnostic fragments (29.7% of the identified fragments). The strong colours, high frequency of decoration and matrix characteristics of many of the jars render it likely that a very high percentage of the fragments of these vessels in the sample assemblage have been identified, and that the percentage of identified jar fragments (by sherd count) is statistically overrepresented compared to other vessel-forms. Twentynine of the fragments, almost all of them from the MRE area, must derive from only five or six vessels (SF 1, 2, 3, 4, 7 and 8).

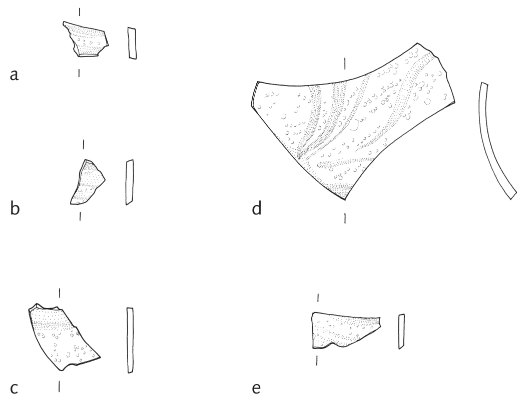
Many fragments are made of streaked (N=12) or marbled and flashed red glass (N=10) and decorated with opaque white trailing and/or reticella rods. Although almost completely covered with red stripes, the base colour of the streaked sherds is very light green-blue or nearly colourless. They most probably represent one or two small jars (SF 2) with a tapering rim. The full profile cannot be reconstructed, but the vessel appears to have had a short neck and a tapering rim with an external lip (Type 2) (Fig. 9.16). A parallel has come to light at Helgö (Holmqvist 1964:258, fig. 125), and this rim-form is also seen on very squat vessels of the 7th and 8th centuries (Rademacher 1942:pl. 65.1; Evison 2000:69, fig. 3.16). A number of white on body-coloured (partially streaked) reticella cables rise vertically from the base to a zone of thin horizontal white trails wound around the body. Further trails are found from the rim down towards the shoulder. The base, unfortunately, is not preserved.

The shape of a red marbled vessel (SF 3) is less certain, but the vessel appears to be closed rather than an open bowl-form (Fig. 9.17). A find from Dorestad (Baumgartner and Krueger 1988:no. 16) suggests its shape, but the Kaupang vessel has a smaller body diameter (10–11 cm). The matrix consists of alternating layers of light blue-green and opaque red and black marbled glass. White on light blue-green reticella rods rise from the kicked base. About 4 cm of the body and base is preserved, but no sherds from the upper part of the vessel.

Another small group of five sherds (SF 8) is associated with a green-yellow globular vessel. The matrix is extremely "bubbly" and readily recognizable (Fig. 9.18, Fig. 9.62.ah-ai). Little of the vessel is preserved, but enough to indicate a rounded body, decorated with combed and feathered marvered white trails. The fragments resemble a small jar

Figure 9.18 *Fragments of green-yellow jar with bubbly matrix and white feathered decoration (SF 8) (**a–e:** C52519/11328, /19912, /29001, /4192, C52516/2584). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

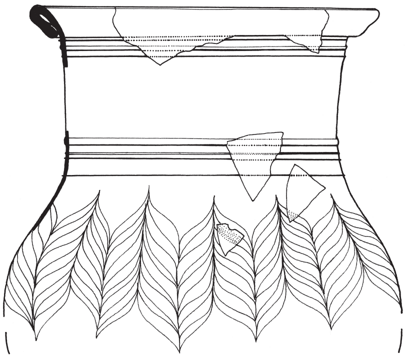
Figure 9.19 *Globular jar from Dollerupgårds Mark, Jutland. Height: 7.8 cm. Photo, Kit Weiss, National Museum of Denmark.*



from Dollerupgårds Mark, Jutland, with a bright blue-green, bubbly matrix and marvered combed and feathered decoration (Fig. 9.19; Hansen 1987:no. 186). Similar decoration is also seen on a small 7th-century jar/cup from Castel Trosino, Italy (Stiaffini 1993:fig. 1.23), and fragments from Dorestad (Isings 1980:fig. 155), York Minster (Evison 1995:no. 5), York Fishergate (Hunter and Jackson 1993:fig. 468, nos. 4650, 4651, 4653, 4654 and 4656), and Hamwic (Hunter 1980:fig. 11.2.10). According to Evison (2000:80) the colour and decoration of the jar from Dollerupgårds Mark are typical of the 8th century, but the other examples are spread throughout the 7th–9th centuries. All the fragments of this kind recovered at Kaupang are from the later medieval plough-layer or the modern ploughsoil and cannot be precisely dated.

Another group of fragments (SF 7) is made of dark green glass decorated with pale yellow trails. The matrix is streaked and appears nearly black in reflected light. The rim is short and angular with an outsplayed profile and a deep, flattened, external fold which is not closed (Type 1b). Around the neck, and partly inside the fold, the jar is decorated with tightly wound trails of yellow glass. A zone of marvered trails, set at an angle (combed and feathered?) can just be glimpsed below (Fig. 9.20). No sherds from the lower body or base of the vessel have been identified. A similar vessel rim, albeit of slightly smaller proportions, has been identified at the nearby hall site of Huseby (Gaut 2004:C52518/85; Skre and Stylegar 2004:fig. 75 middle right).

Another jar with vertical white on body-coloured reticella cables and horizontal white trails (SF 1) is represented by three unusually large, linked fragments that together make up about 25% of the vessel circumference. Unfortunately, neither the rim nor any parts of the base are preserved, but the limited body diameter indicates that this is a small jar with relatively straight profile (Fig. 9.21; cf. Birka



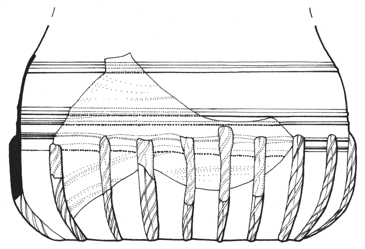


Figure 9.20 *Reconstruction of dark green jar with yellow trails (SF 7). Rim diameter c. 10.5 cm. Height unknown. (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 9.21 *Reconstruction of small jar (SF 1). Maximum body diameter c. 9 cm. Rim diameter and height unknown. Vessel-form reconstructed after Birka graves 739/750. (C52516/4537 and /4191, C52519/11253). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

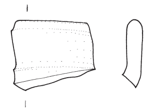


Figure 9.22 *C52519/38383, probably the rim of a small shouldered jar. Rim diameter 4–5 cm. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 9.23 *Glass bowl from Valsgärde Grave 6 (Sweden). Height 6.8 cm. Rim diameter 14 cm. Estimated volume: 0.9 l. Reproduced with permission of Museum Gustavianum, Uppsala.*

graves 735 and 739; Paderborn: Stiegemann and Wemhoff 1999:catalogue no. III.68) and not a bowl (Stiff 1996:65). The decoration is reminiscent of that seen on jars from Birka grave 649 and Hopperstad (Arbman 1940–3:pl. 189.3; Hougen 1968:fig. 7a). However, the high frequency of vertical cables is more akin to finds from Dorestad (Baumgartner and Krueger 1988:nos. 13–14).

Two other *in calmo*-decorated rim-fragments (Type 6b) (C52519/9886 and C52264/723) are also likely to be from small squat jars with constricted necks and outsplayed rims, like those from Hopperstad and Birka grave 649. A further rim of this kind has come to light in a 10th-century grave at Kaupang (Ka. 277: see Appendix 9.2). The Hopperstad and Birka graves should probably also be dated to around AD 900 or in the early 10th century (Kyhlberg 1980:70–4 and 81–2; Gaut 2002:212–3), and both the settlement finds from Kaupang have been made in the modern ploughsoil. Two *possible* jar fragments with reticella decoration and applied rims have, however, been recovered from layers dated AD 800–50 in Ribe (Lund Feveile 2006:appendix 2, tab. 51), and other 9th-century examples have come to light at Dorestad (Isings 1980:fig. 154.1 and 154.4–5).

Finally, a small light green-blue rim-fragment (C52519/38383), probably from a shouldered jar with constricted rim, is to be mentioned (Fig. 9.22). The simple rounded rim (Type 5a) is set at a straight angle to the vessel wall. Because the vessel is undecorated other fragments are likely to go unnoticed. The dating of this vessel is uncertain.

In his discussion of drinking equipment in Viking-period graves, Michael Müller-Wille (1976:132–5) does not distinguish functionally between glass jars and funnel beakers, and regards both as forms of drinking cup/beaker. Not all jar-forms, however, would have been very practical for this purpose, and differently shaped vessels are perhaps likely to have served different functions.

A study of the find-combinations of jars in furnished graves provides no conclusive evidence of their function. The position of the vessels can be determined with some accuracy in nine of the inhumation graves from Birka containing jars, or fragments thereof (Arbman 1940–3; cf. Arwidsson 1984:tab.24:1). The most frequent position is by the deceased's head. This position is different from that of the majority of funnel beakers, where seven of nine examples are found by the feet of the deceased. However, the find-combinations associated with jars (cf. Müller-Wille 1976:fig. 57) provided no clear indication of their use. The most frequent combination (a much higher frequency than for funnel beakers) is with bronze bowls and/or wooden buckets, and not ceramic jugs. In a couple of cases the jars were found with broad-shouldered ceramic storage jars of Slavonic types. On the other hand, only one or two of these graves contained other obvious drinking vessels. As far as one could expect the presence of drinking vessels, that function can only have been served by the jars (if not by wooden vessels that have decomposed). Organic residues that could help to determine their use are not known from any glass vessels in post-Migration-period Scandinavia (Aasheim 2007:30–6 and 40–8).

Unlike tall palm cups and funnel beakers, jars

are stable when placed on a flat surface. They may therefore have been used as fine tableware containers or for storage purposes. From 9th- and 10th-century Chinese sources it is known that Muslim merchants traded sugar, spices and rose-water transported in squat, closed glass vessels. Later (11th-century) goods exported in this way included petroleum (Shindo, 2009:312). A similar use of some of the glass jars that found their way to Kaupang is possible, but perhaps rather unlikely. Their limited size suggests storage of precious goods or table serving. Several illuminations from the early 9th-century Utrecht Psalter (Utrecht Universiteitsbibliotheek MS 32/484; Dufrenne n.d.) show vessels with a squat body, constricted neck and flaring rim standing on tables, often with a spoon or ladle for serving food or strong drinks.

While jars with tightly constricted necks would probably have been impractical as drinking vessels, more open jar forms like those found in Birka graves 739 or 539 and the white reticella-decorated jar (SF 1), the red streaked jar (SF 2) and the grape beaker (C52519/38381) from Kaupang would have been more suitable. Evison (1995:481) has noted that jars with a tapering rim profile like the red streaked Kaupang jar replicate Carolingian silver vessels such as the Fejø cup (Wamers 2005a:no. 43) and even more closely a find from Ribe (Wamers 2005a:no. 28). Wamers (1991a, 2004) has argued that both vessels were originally pyxes. They appear, however, to have been used in Scandinavia as part of drinking sets, possibly to serve alcoholic beverages into smaller wooden or metal bowls (Wilson 1960:171–2). The vessel-form was also replicated in Scandinavia (e.g. Wamers 2005a:nos. 43–4). The relatively small size of the silver and glass cups (the slightly larger Halton Moor vessel has been estimated to hold about 3 dl: Wamers 1991a:98) indicates that these drinking sets were not used for the consumption of large quantities of fermented herbal drinks or ale. It has been suggested that the cups/dishes could be used to serve small amounts of strong honey and fruit brews (OE *meodu/bēor*; ON *mjöðr/bjór*:[4] Fell 1975:90; Strang and Brennan 1976:20; Trotzig 1981, 1984:226–8; Hagen 1994:207).

It thus seems the Kaupang jars could have served several functions: both the storing and the serving of precious commodities and use in drinking ceremonies along with smaller shallow dishes of metal or wood. The kind of liquid served from the glass cups/jars is likely to have been different from the wine poured into funnel beakers from ceramic jugs and it is possible to argue that the two vessel-forms were used for the consumption of different drinks.

Forms of bowl

Bowls can be defined as open vessels, with a convex profile and flat or only slightly rounded, kicked base. The rim and body diameter of the vessel is normally much larger than its height, and varies, according to Matthew Stiff (1996:65), between 11 and 15 cm in the Early Middle Ages (the majority are 13–14 cm). The rim-fold can be open or closed, but always of a

4 It is argued that *bēor/bjór* does not refer to a grain-based beer or ale but a strong fermented fruit drink (Fell 1975; Hagen 1994:205–7).

deep external type which covers parts of an upper zone of horizontal trails. Both the rim diameter and the trails inside the fold are diagnostic attributes. All known examples are also decorated with vertical reticella rods rising from the base. The classic type-example from Valsgärde grave 6 also has a horizontal band of reticella rods around the body of the vessel (Fig. 9.23). This appears to have been replaced by horizontal trails on other vessels (e.g. Holmqvist 1964:figs. 114 and 116) or is omitted.

Bowls are much rarer than funnel beakers and jars in Early-medieval glass assemblages, with most known examples from the 7th and early 8th centuries. Fragmentary material from Dorestad (Isings 1980:fig. 154.6), York (Hunter and Jackson 1993:fig. 644, top right), Helgö (Holmqvist 1964:figs. 112, 114 and 116), Borg in Nordland (Holand 2003a) and the destruction layers of San Vincenzo al Volturno in Italy (Stevenson 2001) indicates, however, both a variety of shapes and decorations, and a continuous circulation of this vessel-form throughout the 8th century and into the 9th. A major problem is that, in the absence of horizontal reticella rods, small body sherds lack diagnostic features and are unlikely to be identified.

Only one fragment from Kaupang (C52519/10288, Fig. 9.62.bv), a rim sherd of relatively thick, medium green glass, with a deep flattened fold and a tubular cavity (Type 1a), can securely be classified as a bowl. Three thin opaque white trails are preserved inside the fold. The rim-form and the slightly in-turned rim profile with a diameter of 14–15 cm are similar to those on the Valsgärde bowl. It is possible that other undiagnostic, convex, relatively thick, green body sherds are from the same or similar vessels. During Blindheim's excavations, at least one rim sherd from a similar bowl was recovered (D64/4p).

Other *possible* bowl fragments include a blue vessel sherd with horizontal opaque yellow trails (C52264/932, Fig. 9.62.ad) and sherds combining horizontal trails and vertical or looped reticella rods (C52264/483, Fig. 9.15.b; C52517/2136, SF 20, Fig. 9.62.bd-be). These decorative schemes have in the past been associated with bowl-forms (Holand 2003a:213–15; Näsman 1986:78), but may also be found on jars or funnel beakers (above).

Like jars, bowls are stable when placed on tables or similar surfaces. The shape and the relatively large volume must have been suitable for the serving of *communal* food or drinks. Greta Arwidsson (1942a:71–2) has suggested that the bowl in Valsgärde grave 6 was not a drinking vessel because it had been placed together with kitchen utensils and other travelling equipment in the grave rather than immediately to the right of the dead where other glass beakers and drinking horns are habitually placed in this cemetery. Several funnel beakers – drinking vessels *per se* – have nevertheless been found together with buckets and bronze bowls in Viking-period inhumation graves (cf. Müller-Wille 1976:fig. 57), and there is no positive evidence to suggest particular uses of bowls in Scandinavian Viking Period. On Continental ecclesiastical sites bowls are primarily associated with refectories and guesthouses where food was regularly served to large groups of people (e.g. Stevenson 2001:203–8). Some of these assemblages also comprise shallow dishes interpreted as decorative fruit bowls (e.g. Newby 2000).

The drinking of beer from a shared bowl that is passed around is frequently described in medieval and later Scandinavian sources (Elias 1978; Høie 2006). Such occasions served to emphasize the equality and social cohesion of the drinkers (Qviller 1996). Although bowl fragments are difficult to identify and similar tableware could have been made from wood or metal (cf. Müller-Wille 1976:fig. 57), the low number of such finds from Kaupang and other Early-medieval market towns must be significant for the interpretation of the social setting around alcohol consumption in these places. The situation appears to follow patterns that have little in common with later rural Scandinavian culture and is rather an absorption of Continental customs (below, 9.5.3).

Undiagnostic, decorative groups

A number of other fragments form discrete groups, although the vessel-forms cannot be determined. Amongst these are a number of nearly colourless fragments decorated with unmarvered white and/or marvered yellow trails, roughly horizontally applied to the body (SF 10, Fig. 9.62.ae-ag). The combination of white and yellow trailing is unusual, but examples are known from Early-medieval Ipswich and London (Stiff 1996:B/174, B/176, C/39 and C/109) as well as Ribe (Lund Feveile 2006:fig. 22). The sherds from London are probably from a squat jar. From the terp of Wijnaldum in Frisia a fragment of a pouch-shaped or cylindrical beaker with the reverse pattern, marvered white trails covered by unmarvered yellow, has been uncovered from an early 8th-century deposit (Sablerolles 1999:232). In Ribe, yellow and white trailed sherds occur throughout phases B–E (with an emphasis on Phase C) and increase again in frequency during phases G–H/I, where they make up 28.6% of the trailed sherds (Lund Feveile 2006:fig. 22).

This colour combination is also found on vessels decorated with cables twisted from both yellow and white trails (e.g. SF 14: Fig. 9.15.a). One of these sherds (C52516/193) also shows traces of applied yellow trailing. Similar combinations are known from Southampton (e.g. Hunter and Heyworth 1998:nos. 11/160 and 17/782), Ipswich (Stiff 1996:B/53), Ribe (Lund Feveile 2006:tabs. 43–4), and on an 8th-century bowl from Lundenwic (Stiff 1996:245).

Another large group of sherds are from a vessel with very light blue matrix and applied white marvered festoons and horizontal trails (SF 4). The sherds have predominantly been grouped by decoration. The matrix itself is not very distinct (despite the occasional presence of some black impurities), and it is possible that additional undecorated fragments in the assemblage have gone unnoticed. Morphologically the decorated fragments can be related both to squat jars with a constricted neck and funnel beakers, and it is plausible that the group consists of two quite differently shaped vessels (Fig. 9.24). No rim- or base-fragments have been identified.

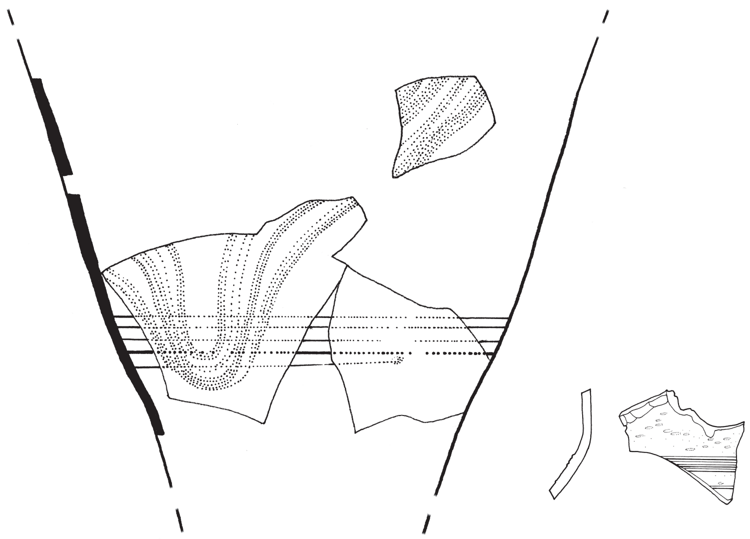


Figure 9.24 *Vessel-fragments with white trailing and festoons (SF 4) (Scale 1:2). One sherd could not be fitted into the reconstruction (scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

9.2.4 Spatial analysis

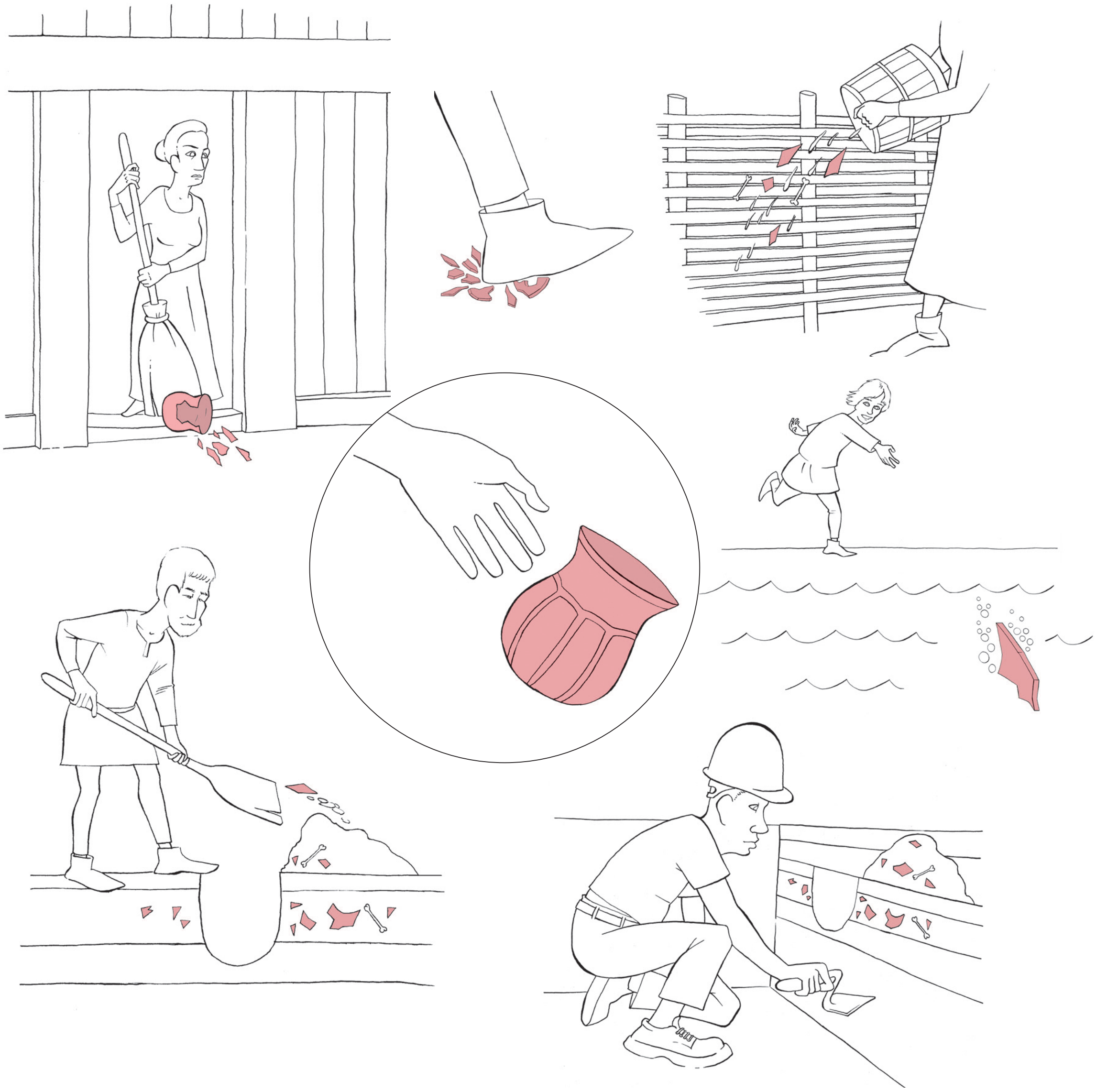
The formation of an archaeological site is the result of a number of different processes. Schiffer famously distinguished between cultural and non-cultural transforms (1987:22). Both sets of processes are important to understand site development, but apart from minor movements in the soil matrix from freeze/thaw processes, bioturbation and burrowing, non-cultural transforms are not likely to have affected the spatial distribution of the Kaupang glass to any great extent. It is the cultural factors – the various ways humans have shaped the structure of the assemblage through depositional and post-depositional activities – that are of principal importance.

The cultural transforms are likely to involve not only unconscious layer accumulations, but also selective, conscious events of dumping and modification of the landscape. It can be argued that the artefact patterns that are observed at Kaupang, together with a measured consideration of the recorded context information and the site-formation processes, can be used indirectly to study the cultural attitudes behind these processes (Andrén 1986; Økland 1998; Tagesson 2000:157–71; Lindell and Thomasson 2003:15–20). The most obvious aspects are perhaps the use of and attitudes to material culture, spatial and social organisation, handling of waste, and cultural preferences with regard to food and drink. Moreover spatial distribution is a key to understanding whether some of the material was selectively treated or deselected prior to deposition, and to understanding post-depositional processes that have otherwise shaped the fossilised site record (Schiffer 1987; Larsson 2000:117–44; Tagesson 2000:158–60).

The remainder of section 2.4 will largely be used to explain the theoretical background to the methods used to address these questions. I will concentrate on three main aspects: approaches to spatial analyses; the effect of recovery rates on assemblage interpretations; and vessel quantification. Readers who are more interested in the practical application of these methods on the MRE assemblage from Kaupang can proceed directly to section 9.2.5 (below). For clarity, following Ringrose (1993), I shall distinguish between the *live assemblage* (the original material in use), the *deposited assemblage* (the proportion of the live assemblage that has been deposited on the site as a consequence of either depositional or post-depositional factors), the *fossil assemblage* (the material that survives deposition), and the *sample assemblage* (the part of the fossil assemblage that is recovered by archaeologists) (Fig. 9.25).

Recovery and analytical approaches

Ewan Campbell's work in the early 1990s on the fragmentation and intra-site distribution of vessel glass from Dinas Powys in Wales was groundbreaking (Campbell 1991:50–70, 2000:37–8). Faced with a large and heavily fragmented glass and pottery assemblage, Campbell decided that new analytical approaches were needed to acquire meaningful information from the material. He found inspiration in ethno-archaeological studies of waste-disposal and site-formation processes (e.g. Hayden



and Connor 1983; Schiffer 1987). These provided examples of artefact-disposal patterns and showed a correlation between activity zones and increased pottery-fragmentation. While vessel sherds that were quickly disposed of in middens were generally preserved in large pieces, fragments left in activity areas were broken down by continuous trampling until they reached a minimum size.[5]

Because vessel glass shares many characteristics with pottery, Campbell (1991:63–70) applied the same basic assumptions to this artefact-group, and used the results from this analysis, together with vessel identification and refitting, to develop an understanding of the different cultural deposition factors at play. By measuring and plotting the size of the vessels it was possible to track the intensity of movement in different parts of the site, and to indicate where activity areas, middens and footpaths were located. Debitage showed that groups of sherds from individual vessels formed discrete clusters representing the discarding of broken vessels. Other sherd concentrations in workshop areas indicated that some fragments were selected for recycling prior to being discarded. These results differed radically from earlier suggestions that *all* the vessel glass uncovered at Dinas Powys had been brought to the site as fragmentary raw material (cullet) for bead-making (Alcock 1963:52–3).

The example of Dinas Powys demonstrates how a detailed study of a vessel assemblage may give unexpected results. However, Campbell's approach is labour intensive, and to apply similar methods to large sites, like the specialised production and market sites around the North Sea basin, requires resources on a scale normally not available to commercial archaeology. Even research papers tend to concentrate on vessel identification, rather than

5 The force required to break the sherd repeatedly would steadily increase due to the combined physical properties of the vessel curvature, the surface area, and its thickness: Campbell 1991:51–2.

Figure 9.25 *Illustration of the relationship between the original "live assemblage" of vessel glass and the "sample assemblage" recovered by archaeologists at Kaupang, and some of the taphonomic processes transforming the archaeological record. Illustration, Rune Borvik.*

exploring the spatial distribution of the sherds. Nevertheless, detailed analyses of selected contexts at the Italian monastery of San Vincenzo al Volturno (Hodges 1992; Dell'Acqua 2001; Stevenson 2001), as well as more extensive analyses of the settlements at Borg in Lofoten (Holand 2003a), Eketorp-II on Öland (Näsman 1984, 1986), and the Bergen wharfs (Høie 2006), show that such work can provide important information about the use and handling of vessel glass in past societies. A brief assessment of the Lundenwic material (Clark 2005) has indicated a potential for this kind of analysis also in specialised production and market places.

The need for good preservation conditions and stratigraphical control limits, however, where analyses of this kind can be applied. The otherwise important assemblage from Early-medieval Southampton (Hamwic) derives almost completely from negative features cut into the subsoil, while horizontal layers have been truncated (Morton 1992; Andrews 1997; Hunter and Heyworth 1998:58–60). The sample assemblage therefore provides a very incomplete sample of the live assemblage and the contexts in which glass would have been deposited. As a result, John Hunter and Michael Heyworth's discussion of vessel quantification and the spatial distribution of the material remains academic (1998:30–3). Their publication basically takes the form of a qualitative analysis. At the Six Dials site, where a closer analysis of the preserved horizontal deposits could have been carried out, Hunter and Heyworth chose to pursue a different research agenda.

Another obstacle to spatial analysis is the reliance in much modern archaeology on partial sampling rather than full-scale excavation and the sieving of excavated deposits. During the recent excavations at the *Royal Opera House* site (1990–1992) in Lundenwic, which is the only other comparable English site to Hamwic with regard to settlement density and glass finds, only about 5,600 of the 200,000 litres of soil excavated was sieved. It has been estimated that the proportion of glass objects recovered probably was as low as 10% of the sample assemblage (Stiff 2003:242). Matthew Stiff (1996:302) has pointed out that water-sieving would principally increase the number of small fragments in the excavated sample, and that this is a costly exercise without necessarily increasing the number of identified vessel-fragments. However, from the point of view of a spatial analysis, I would argue that also the smaller fragments are useful because they are charcteristic of certain activity areas and site-formation processes. Partial collection of an already limited fossil assemblage (no matter how statistically valid) will make analyses based on refitting and spatial distribution less refined and accurate.

Although a detailed intra-site analysis of vessel glass was not attempted at the London *Royal Opera House* site, some observations made there with regard to pottery distribution may still be of relevance to the study of vessel glass from Kaupang (Malcolm et al. 2003:143, tab. 16). To measure the degree of movement of material across the site, sherd links in the illustrated pottery were analysed. Fragments from 32 of the vessels (20.4%) were found in more than one area of land use (individual properties or plots). The greatest distance between sherds of the same vessel was 45 m (Malcolm et al. 2003:81–2 and 115–18). This may in part have been the result of a "centralised" removal of waste to open areas, but it is also likely to be a result of other taphonomic processes. Sherds from 21 vessels (13.4%) crossed period boundaries as well. The analysis indicates that activities leading to the redeposition of soil (for example the construction of pits, recutting of features, levelling of destruction layers etc.) must have been frequent in Lundenwic (and probably also at Kaupang) and that a large proportion of the small finds lying around at any one time were likely to have been residual (Malcolm et al. 2003:142). The same effect is reported (albeit less clearly demonstrated) at Hedeby (Schietzel 1981:53–61).

In comparison, cross-fitting of linked artefacts (mainly pottery and soapstone vessels) from the 11th- and 12th century-settlement phase in Bergen has showed that people there generally did not throw waste on to neighbouring plots (Hansen 2005:48, fig. 6). Only 2 of 64 links crossed a contemporary plot-boundary. A similar impression was formed during the excavation of 11th-century layers in Lund and Sigtuna (Roslund 1997:41–3). In this case, one may be more certain that artefacts found on a plot represent activities taking place within the same unit of land.

The above examples demonstrate the limits to contextual analyses. Although I maintain that the distribution of small finds is likely to be the best method of mapping activity zones and spatial relationships within a settlement, one cannot rely too heavily on artefact assemblages for site dating and the correlation of features across plot-boundaries and occupation phases. Specifically, it would seem hazardous to use sherd links of vessel glass to identify features as contemporary and to phase excavation contexts across plots, because an unknown quantity of the material is likely to be redeposited. The analyses of the Kaupang material (below) indicate, however, that vertical redeposition was probably more prevalent than horizontal in the stratified deposits.

Secondly, the examples reveal that the handling of waste and the frequency of redeposition are cultural variables, depending, inter alia, on social conventions, notions of hygiene, the presence or absence of central authority, and settlement density (e.g. Økland 1998). Parallels and analogies used to interpret the archaeological data should therefore be as close, culturally, as possible to the phenomenon one wants to understand. I have tried to underline throughout this work that contemporary Scandinavian and North-West European urban sites are likely to provide a better framework to understand Kaupang than rural Viking-period society.

The number of good comparative and glass-rich sites is, however, limited. Several sites have been mechanically excavated (e.g. Hedeby: Steppuhn 1998; Dorestad: Isings 1980; cf. van Es and Werwers 1980) or are stratigraphically poorly understood (e.g. Helgö: Lundström 1981). The publication of other sites is delayed by the post-excavation analyses and shortage of resources. Potentially important assemblages from the settlement areas of Åhus I/II and Birka (1990–1995 excavation) remain as yet unpublished (for shorter reports see Callmer 1990, 1991b, 2002; Ambrosiani 1995:63. For smaller excavations in other parts of Birka see Danielsson 1973; Henricson 1993). On the other hand, the important *Posthus* site in Ribe has recently been published in an exemplary manner (Lund Feveile 2006). This typo-chronological study, which takes full advantage of the site's exceptional stratigraphical record, will undoubtedly become a reference point for vessel glass too. However, the limited area of excavation prohibits any meaningful interpretation of the horizontal distribution of the sherds. At Groß Strömkendorf (Pöche 2005) site-preservation has limited the scope for spatial analyses, although the published vessel assemblage in itself provides and important comparative late 8th- and early 9th-century material.

The later medieval towns can also provide some insight into the social organisation of early urban societies. Kristine Høie (2006:2–8) points out that the density of finds and the methodological approaches developed for bulk finds in these contexts should also be well suited also to glass analyses. However spatial analyses of glass finds are rarely attempted due to the general scarcity of glass finds and the lack of continuous excavation areas that allow for an assessment of the relationship between finds, buildings and other structures. Only from the 13th century does the increased number of glass finds in Bergen make assessments of glass use and discard patterns meaningful on a macro level (Høie 2006:46–77).

When it was decided to undertake a large-scale contextual analysis at Kaupang, combining spatial patterns, debitage and compositional analysis, it was because several factors lend the vessel glass to such studies. The assemblage is one of relatively few sherd collections to have been recovered from stratified horizontal deposits. Moreover, a research-led excavation strategy enabled total excavation of the cultural deposits in the MRE area and a near complete recovery of the deposited glass (9.1.2). Because soda-lime-silica glass is a very stabile material, the fossil assemblage and the sample assemblage from the stratified archaeological deposits at Kaupang are likely to be very similar to the deposited assemblage. Finally, the extent of the area uncovered, with its continuous surface of excavated plots, buildings, pathways and pits, provides a meaningful context to study how activity was structured within the settlement. It must nevertheless be borne in mind that other sherds associated with the recovered material were deposited outside the excavated areas.

Vessel quantification

Above (9.2.1, Fig. 9.8), the proportion of different vessels at Kaupang was presented simply by reference to their sherd count. This, however, is unlikely to provide an accurate picture of the live assemblage. Sherd links show quite clearly that many fragments were originally part of the same vessel. It is more difficult to determine how many different vessels the unlinked and unidentified fragments represent, because the degree of fragmentation depends on depositional and post-depositional factors that can be highly variable.

When comparing assemblages from different sites, the archaeological practices and methods also determine the character of the sample assemblages. Part of this problem can be rectified by selecting sub-samples that have been collected in a similar way (e.g. through wet-sieving of cultural deposits) from similar-sized segments of the settlements (best measured as volume of excavated soil, although this does not take account of the character of the soil matrix). Nevertheless, any initial bias caused by a dissimilar fragmentation frequency makes quantified comparison based on sherd count alone difficult.

A slightly better alternative could be to base direct quantification on rims and/or base-fragments only. This, however, excludes the majority of vessel-fragments from the comparison, and in a small glass assemblage will easily lead to results that are not statistically valid. It is therefore imperative to develop other methods to illuminate the relationship between the fragments recovered and the live assemblage. Although the detailed sequence of fragmentation and subsequent dispersal of individual vessel-parts will necessarily remain hidden to us, a stringent methodological approach to quantification may at least facilitate a general characterisation and help to make comparison of site assemblages as relevant as possible.

Vessel-quantification technique is one of the fields where glass studies have advanced significantly over the last 10–15 years (e.g. Cool 1994; Cool and Baxter 1996, 1999; Hunter and Heyworth 1998:30–3; Baxter 2003). A number of methods, concentrating on the calculation of the relative proportion of different vessel-types on a site and the reconstruction of the live assemblage, have been developed to study ceramic assemblages (Orton 1993). Until recently, however, these have only been applied to a minor extent to vessel glass because this material normally survives in much smaller quantities than pottery on a site, and because many methods devised for pottery are not immediately applicable (Baxter 2003:220). John Hunter and Michael Heyworth have modified and tested various standard methods to present the proportion of different rims and bases from the *Six Dials* site in Hamwic (Hunter and Heyworth 1998:30–3, tabs. 3–4). Their comparison of the figures given by *count*, *weight*, *surface area* and *minimum number* revealed no "superior" method. Instead, Hunter and Heyworth concluded that the range of results formed a good starting point for further interpretative discussions. For example, the relationship between count and adjusted weight can reveal variations in fragmentation between different groups of glass. Compared with minimum numbers, the percentage given by count is likely to indicate whether a vessel group derives from a large or small number of individual vessels. This is of some importance for the Kaupang assemblage, where it has been questioned whether the glass was imported in the form of complete vessels or as fragments for reworking. On a more general note, body-fragments are likely to be over-represented through count, because they make up the largest proportion of the vessel surface and are thinner, and so break into smaller fragments. This would be particularly true of vessels like funnel beakers. Funnel bases are, on the other hand, likely to be under-represented because of the smaller surface area and the thickness that makes them less susceptible to breakage. This is clearly observed if the percentage given by count is compared with that of weight.

Another method, rejected by Hunter and Heyworth, is that of vessel equivalents. To clarify what is meant by this method, it is sensible to introduce the concepts of *sherd family, vessels represented*, and *vessel equivalent*. A Sherd Family (SF) is defined as "all sherds in one context that belong to the same vessel. …Vessels represented are equivalent to the number of sherd families present, whereas vessel equivalent is obtained by summing the proportions of the vessels present in the sherd families" (Baxter 2003:216). Since the exact number of vessels represented is often difficult to establish, *estimated vessel equivalents* (EVEs), are often used instead. For pottery, the method is based on measuring the preserved proportion of the rim. For Roman glass, Hillary Cool and Michael Baxter (1996) have suggested using information drawn from the whole vessel profile, including handles, body, base etc. This is because these parts of the vessels normally represent a large proportion of the assemblage, and because information about glass assemblages must be maximised since they usually are smaller and more fragmentary than pottery assemblages. This approach also helps to maximise the basis on which further statistical modelling is based.

It must be stressed that the PIE and EVE values are relative, statistical figures. They do not represent absolute numbers in a live assemblage or information on individual vessels thereof (Moreno-García et al. 1996; Baxter 2003:218). However, the statistical methods described by Cool and Baxter can be used to estimate a hypothetical number of whole vessels that would give rise to the same variance as in the measurable record (PIE) (see below, 9.5.2). PIEs and EVEs can also be useful means of comparing site assemblages quantified in the same way.

Unfortunately, no scheme for the estimation of vessels equivalents similar to that developed by Cool and Baxter for the Roman Period exists for Viking-period glass vessel-types. The form-elements are generally less distinct, and a greater proportion of the material remains unidentified and uncountable. In consequence, no Viking-period assemblages have to my knowledge been published with EVE calculations. Another problem is that the methodology presupposes that all sherds in the sample assemblage represent complete vessels. Any depositional biases, either in the form of partial cullet import or the selective removal of fragments for recycling – both plausible possibilities at Kaupang – are likely to affect the usefulness of the methodology.

A successful application of vessel equivalents or EVE depends on the prior identification of the vessel-fragments belonging to the same Sherd Family. A good pragmatic solution through which to achieve this is to use a quantification technique called *estimated minimum numbers* (EMN). This is based on a subjective assessment of sherds of different qualities (Sablerolles 1999:229–30). The method is related to *minimum number of individuals* as used in ceramic studies but is adjusted to glass by taking the spatial distribution of sherds into account to estimate the

Site Period	Period of occupation	(Sub-phase)	Preserved deposits	NVF	EMN
I	5–10 years	-	All plots	6	5
II	c. 40 years	1	All plots	31	14–15
		2	All plots but 1A	26	7
III	-	-	Pits/post-holes 1A, 3A, and 3B	2	2
Ploughsoils	Disturbed	Late-medieval	Parts of all plots	14	4–5
		Modern	All plots	Not collated	Not estimated

Table 9.6 *Number of vessel-fragments (NVF) and the estimated minimum number of vessels (EMN) represented on the excavated and phased plots (1A, 2A, 2B, 3A and 3B). Vessels are attributed to the earliest Site Period in which the Sherd Family occurs since fragments uncovered from later deposits are likely to be residual. For a further breakdown of the figures see the following text.*

likely minimum number of different vessels contributing to the sherd assemblage. To maximise the potential of this method, the present study also combines the morphological assessment with compositional analyses and debitage. The result is presented in the following overview of the Site Periods (Cf. Appendix 9.3).

Towards the end of this work (below, 9.5.2) I return to an estimate of the vessel equivalent of all vessels from the MRE assemblage for a statistical extrapolation that visualises the *possible combined quantity of glass vessels on the site*. However, this conjecture is only possible based on the spatial analysis carried out in this chapter, and must not be treated as precise, or as methodologically independent.

9.2.5 Site development and glass consumption in different Site Periods

This section of the text will explore the deposition rate and deposition pattern for vessel glass in the MRE trenches at Kaupang. After a brief assessment of the excavation data and a synopsis of the subsample, the reader will find a detailed presentation of the assemblage, Site Period by Site Period. The discussion includes a numerical overview and establishes the relationship of the glass to other sherds and to the excavated structures. These data form the basis for the more comprehensive cultural interpretation that can be found in 9.2.6, below. Readers who are not interested in the details of specific sherds can proceed directly to that section with clear consciences.

The most detailed information about the settlement sequence at Kaupang come from the open area research excavations (MRE) of 2000–2002 (Pilø 2007c, 2007d; Pedersen and Pilø 2007; Pilø and Skre, this vol. Ch. 2). The horizontal layer accumulation in this area spans only the few decades from about AD 800 to 840/50. Within this period, it is possible to follow the sequence on individual plots in some detail. The excavated plots follow the same general development pattern: from a seasonal phase with no buildings (SP I), to a built and permanently settled state (SP II:1 and II:2). A number of large features cut into the later layers can be dated AD 840/50–900 (SP III).

It is difficult, however, to correlate development *between* the plots in detail. Continuous digging of features through older deposits and the recutting of pits and trenches that were already in use must have caused significant redeposition of material. Potential disturbance is also caused by the periodic levelling of plots, perhaps in preparation for new users or in conjunction with the erection of new buildings. Finds plotted across plot-boundaries cannot therefore automatically be regarded as strictly contemporary, and a significant proportion of the glass must be considered residual in its recorded context. Plotted maps are nevertheless produced for the glass finds from the MRE area because this is still the best way to visualise the overall artefact distribution and because the patterns that emerge appear to be meaningful. Vessels are always attributed to the earliest phase in which their Sherd Familes occur when estimating and comparing vessel circulation in the different Site Periods. When particular finds or the stratigraphical record indicate that the correlation of plots is inaccurate this will be noted explicitly.

Only 65 vessel sherds from Plots 1A, 2A, 2B, 3A, and 3B can directly be connected to the site phasing. However, an additional 18 finds from contexts in the immediate vicinity of these plots are also likely to have been deposited in the early 9th century (Tab. 9.2). Keeping the small numbers of finds in mind, as well as the stratigraphical uncertainties concerning some pieces, it is possible to present a conservative overview of the availability of vessels in the MRE area. Even a very coarse presentation of the data indicates that the proportion of vessel glass to other glass finds on the site changes through the first half of the 9th century (Fig. 9.26, Tab. 9.6). Taking into consideration the different lengths of the Site Periods and the uneven preservation of the various deposits there appears to be an increase in vessel-fragments in the phase of permanent settlement (SP

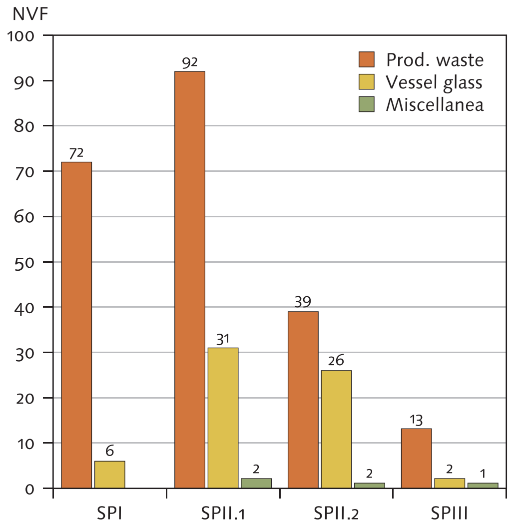


Figure 9.26 *The presence of glass waste and raw materials from beadmaking, vessel sherds, and miscellaneous glass objects (window glass and inlays) in the deposits on the phased plots (1A, 2A, 2B, 3A, and 3B) of the MRE trench.*

II:1 and II:2). From this point onwards vessel glass appears to have been a continuous feature of the settlement's material culture. The 65 stratified sherds and the 14 finds from the later medieval plough-layer, where horizontal movement is believed to have been limited, probably represent only 32–34 vessels.

It is difficult to determine how representative this material is for the site as a whole, but it is visually very similar to the surface assemblage and the glass recovered by Blindheim further north in the settlement area from 1956 to 1974. A discussion of the density of finds compared with other sites as well as the total circulation of glass at Kaupang can be found in the discussion towards the end of the chapter (below, 9.5.1–2). Here, the data for the various Site Periods are considered in more detail.

Site Period I

Very few vessel sherds can be related to SP I (Fig. 9.27, Tab. 9.7). Although many of the fragments appear very similar, compositional analyses indicate that only two of them derive from the same vessel (SF 15). Only two sherds are diagnostic. C52519/22789 (Plot 1A) is likely to be from a green-blue tall palm cup or cone beaker (9.2.3). Its slightly outsplayed tubular cavity rim (Type 1a) is untypical of Viking-period finds, and the conservative rim-form seems to correspond well with the vessel's "early" deposition at Kaupang. Another undecorated vessel-fragment (C52519/25068) from a post-hole cut through the horizontal layers on Plot 1A probably derives from a light blue-green funnel beaker.

C52519/20923 (Plot 2A) is decorated with a thick, opaque yellow trail, partly melted into the vessel surface just below where the rim would have been. This decoration seems to be relatively infrequent in the Early Middle Ages. One close parallel from Dorestad (Isings 1980:fig. 154.4) is from a small squat jar with an applied rim. However, fragments from Hedeby (Steppuhn 1998:pls. 13.25 and 14.3) and Hamwic (Hunter and Heyworth 1998:no. 177/408) indicate that thick trails also could be used to decorate other vessel-forms, such as tall palm cups or funnel beakers.

On the face of it, the sherds indicate a small-scale use of drinking vessels in parts of the settlement area during SP I. However, most of the vessel-fragments are from Plot 2A. The interpretation and dating of these deposits are problematic, and some of the sherds may represent intrusive material from SP II. One glass fragment (C52519/24799) from the border zone between Plots 2A and 3A, linked to SF 5 (SP II:1, Plot 3A), is almost certainly intrusive. The artefact assemblage also includes other material that is likely to originate from later Site Periods; particularly glass beads (Gry Wiker, pers. comm.) and fragments of loomweights (Øye, this vol. Ch. 13:361). Plots 2A and B is also the only area where wheel-thrown, hard-fired Continental pottery has been recovered in SP I (cf. Pilø, this vol. Ch. 10:287, 303).

Although some of the SP I deposits on Plot 2A are clearly contaminated with later material, this is *not* likely to apply to all the vessel-glass fragments. Vessel glass has also been collected from individual Plot 2A layers and Plot 1A where the stratigraphical control appears to be better.[6] Although Pilø (this vol. Ch. 10:303) concludes that the Continental ceramic fine-wares on Plot 2A are likely to be intrusive, it therefore seems rash to exclude the possibility that some of the glass and pottery may represent genuine SP I activity. The identified Continental pottery is mainly Badorf Ware with a few fragments of a Mayen-ware *Kleeblattkanne* (Pilø, pers. comm.).

6 At least some of the deposits from Plot 2A are covered by A406, a building attributed to SP II:1 (Pilø 2007:206–7). Two of the glass fragments recovered from the plot must predate the building activity. Other glass fragments from the CRM trench (SF 11) were recovered from a shallow pit, A11958, which probably predates building A303 (Plot 3B, SP II:1).

Description/Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Light green-blue tall palm cup	1	1		C52519/22789
Undiagnostic, light green-blue vessels, opaque yellow trailing	1	1		C52519/20923
Undiagnostic, very light green-blue vessel	2	1	SF 15	C52519/23450 (heat exposed), C52519/23495
Very light blue-green ?funnel beaker	1	1		C52519/25068
Undiagnostic, very light grey-green vessel	1	1		C52519/21545
Total	6	5		

Table 9.7 *Vessel glass from SP I. NVF = Number of fragments; EMN = Estimated minimum number of vessels. For information on individual Sherd Families, see Appendix 9.3.*

Although originally a wine container, this vessel had been secondarily used for cooking, like much of the Badorf Ware from Kaupang. The finds might indicate that the people who established themselves on Plot 2A in SP I had brought both glass and ceramic tableware and containers with them and discarded what was broken (see further below, 9.5.3).

Although SP I is poor in vessel-glass finds, there is a significant concentration of evidence for glass-working on Plot 1A (below, 9.4.2). In this context, it should be noted that one of the vessel-fragments from Plot 2A (C52519/23450) appears partially melted and deformed – possibly through an attempt at secondary reworking. The layer from which it was recovered (AL77201) also contained other waste products from high-temperature crafts such as metalcasting and beadmaking. The possibility that some of the glass sherds described above could have been brought to the site as cullet for remelting, and not as complete vessels, cannot be totally excluded therefore, although it is unlikely. While the vessel matrices have light translucent colours, the beadmaking waste from SP I is opaque white or deep cobalt blue. Compositional analyses confirm that the levels of colorants and opacifiers such as antimony, tin, copper and lead distinguish the vessel sherds from rods, wasters and locally produced beads (below, 9.4.3). Although a base glass from remelted vessel-fragments could have been coloured prior to the drawing out of rods, no traces of this process have been documented at Kaupang, and it is probable that beadmaking was based entirely upon imported, ready-coloured rods and cakes of raw glass during SP I (see further below, 9.4.1–3).

7 The figure includes one intrusive sherd originally attributed to SPI (C52519/24799) and one fragment (C52519/28367) from the section created by a modern drainage trench, T14859, cut through the deposits.

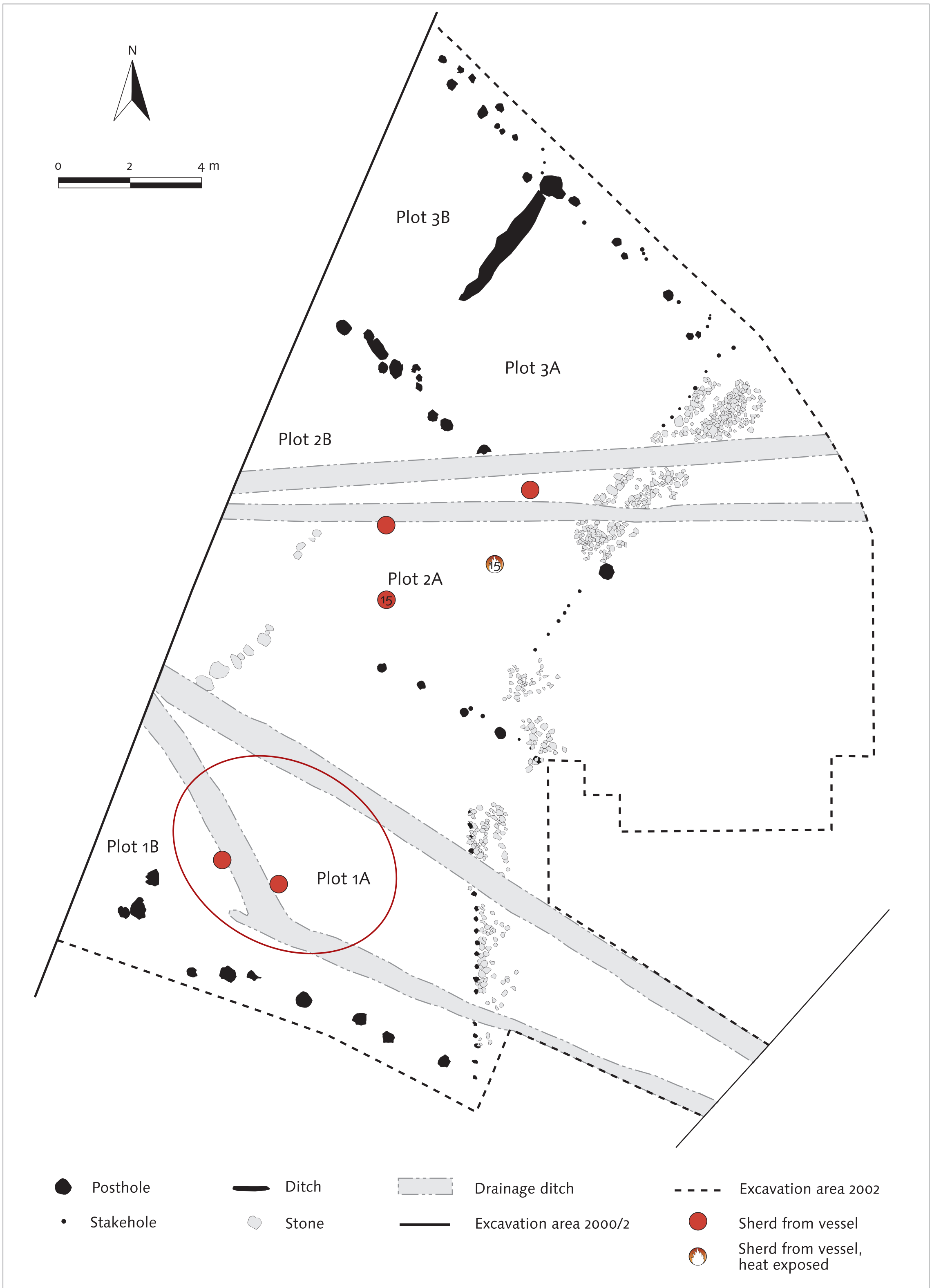
Site Period II:1

A total of 57 vessel-fragments have been recovered from SP II deposits, 31 of which are from SP II:1.[7] Although these include a number of deep blue-green or red sherds the assemblage is dominated by undecorated fragments, many likely to be from light blue or green funnel beakers (Tab. 9.8, Fig. 9.28). Ten fragments can be attributed to this vessel-form. Four are rim sherds; one of which having a deep blue applied rim (Type 6a). In all, it seems reasonable to attribute the funnel sherds to five or six different vessels. Another sherd (C52519/20255) decorated with vertical optic blown ribs *may* also be from a funnel beaker or a tall palm cup. One of the funnel beakers is decorated with marvered white trailing (SF 5).

Amongst other finds that attract specific attention are several red fragments with applied bichrome twisted cables. Several of these sherds are linked with fragments from the later medieval plough-layer covering part of the site, or the transition between this layer and the modern ploughsoil. Fragments belonging to SF 3, a marbled and flashed jar, are concentrated just west of building A200 on Plot 1A. A single sherd also came from the building on Plot 1B in the CRM trench. The location may indicate that the vessel should be associated with activity on either one of these two plots.

SF 2 is distinguished by its red streaked matrix. The sherds are associated with floor deposits in building A200 (Plot 1A), and with a second separate concentration on Plot 4B (below). There are no sherd-links between these clusters, and, although the fragments appear very similar, it is possible that they do derive from two separate jars.

Three almost colourless fragments are decorated with unmarvered white and marvered yellow trails, roughly horizontally spun around the body (SF 10). The vessel-form cannot be determined, but the combination of white and yellow trails is so unusual that the sherds are likely to be from one vessel. Two undecorated fragments from the floor surface of building A406 (Plot 2A) and a larger group of sherds where only the marvered yellow trailing is



present should most likely also be related with this Sherd Family. The SP II:1 sherds form two principal clusters or deposition events: around building A406 and in and around a small pit (A84610) in the area between Plots 2B and 3B. The relatively wide horizontal dispersal of the remaining sherds is due to later ploughing (below, 9.2.7).

Figure 9.27 *Distribution of vessel glass in SP I. Concentration of beadworking waste on Plot 1A is circled. Two sherds from SF 15 in Plot 2A are indicated (Tab. 9.7). Map, Elise Naumann.*

Description / Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Red marbled and flashed squat jar, white reticella decoration	3 (10)	1	SF 3	C52519/21703, C52519/25061
Red streaked jar, white reticella and horizontal trailing	2 (12)	1–2	SF 2	C52519/24047, C52519/10223
Very light green funnel beaker	1	1		C52519/10210 (rim)
Light blue-green funnel beaker	1	1		C52519/9660 (rim)
Undiagnostic, light green vessel	1 (2)	1	SF 17	C52519/24030 (rim)
Very light yellow-green palm cup/funnel beaker, optic blown decoration	1	1		C52519/20255
Very light yellow-green cone or funnel-shaped beaker, white marvered trailing	5 (10–13)	1	SF 5	C52519/20975, C52519/26835, C52519/26087, C52519/28367* C52519/24799^
Very light green funnel beaker, *in calmo* rim	1	1		C52519/21704 (rim)
Very light green-blue funnel beaker with carination	3 (3–4)	1	SF 16	C52519/24595 (rim), C52519/27596, C52519/18573
Undiagnostic nearly colourless vessel, marvered yellow and unmarvered white trailing	5 (8–11)	1	SF 10	C52519/24587, C52519/23406, C52519/20375, C52519/21975, C52519/27957
Undiagnostic light green vessel, thick walled	1	1		C52519/26910
Undiagnostic dichroic colourless/brown-purple vessel	1	1		C52519/19473 (melted, twisted end)
Undiagnostic medium blue vessel	2 (4)	1	SF 18	C52519/24204, C52519/26130 (possible retouch)
Undiagnostic light blue vessel	1	-	Not allocated	C52519/27625
Undiagnostic dark brown-green vessel	1	-	Not allocated	C52519/21782 (melted, bent and ?tool-marked)
Undiagnostic very light green vessel	1	-	Not allocated	C52519/18698 (retouched, possibly re-used in window or inlay)
Undiagnostic very light green vessel, self-coloured trails	1	1		C52519/16470
Total	31	14–15		

Table 9.8 *Sherd Families represented in SP II:1. NVF = Number of fragments. The total number of fragments from all Site Periods associated with the Sherd Family in brackets; EMN = Estimated minimum number of vessels; Not allocated = Fragments with undiagnostic matrix or fragments that might represent glassmaking cullet or other secondarily utilised material, which have not been included in the calculation of estimated minimum numbers of vessels. * = From section wall of modern drainage ditch T14859. Its stratigraphical position is uncertain; ^ = Originally recorded in SP I, but believed to be intrusive. For information on individual Sherd Families, see Appendix 9.3.*

In total, fragments from fourteen or fifteen vessels appear to be represented in SP II:1. It is unclear how many of these were originally in use as containers at Kaupang, but there are *at least* five vessels from which several fragments are preserved. Only few fragments can, however, directly be associated with occupation layers in buildings. Beyond the sherds from SF 2, 3 and 10 commented on above, a blue-green funnel beaker rim (C52519/9660) was recovered from the side-aisle of building A200 (Plot 1A), a possible light green claw-beaker sherd decorated with horizontal body-coloured trails (C52519/16470) from the same building, and an undiagnostic sherd (C52519/27625) from A304 on Plot 3A.

The majority of the sherds come from various refuse and levelling layers. As in other cases where fragments can be attributed to the same Sherd Family due to sherd-links or morphological characteristics they appear to have been dumped either together or on separate sides of the building plots. This is likely to reflect details of refuse disposal (below, 9.2.6). Noticeably, there are no finds associated with the building on Plot 3B in this sub-phase, and it is unclear whether the few fragments found around this plot should be associated with this structure or activity in other areas of the site.

Waste from glassworking is relatively copious (below, 9.4.2). Much of the waste and raw materials are concentrated on Plot 1A, as in SP I, and it is likely that at least some of this is residual material from earlier activity. Another, larger cluster is from the diffuse building remains on Plot 3A. It is, however, difficult to unequivocally conclude that glassworking took place here. Amongst the possible vessel sherds used for cullet, specific attention should be drawn to C52519/19473 (Plot 2A). One end of the sherd is melted and twisted. Another fragment, C52519/19988, is part of a dark blue-green window quarry with retouch along two edges. If the sherd was fitted in a lead framed window at Kaupang, this

Figure 9.28 *Distribution of vessel glass in SP II:1. Sherds from SF 2, 3, 5, 10, 16–18 are indicated (Tab. 9.8). Map, Elise Naumann.*

is an early Scandinavian example of such use (below, 9.3.1). Alternatively, it could be a piece of scrap glass imported for use in beadmaking. The dark colour would make it attractive as raw material or for colouring a glass melt in a similar fashion to tesserae. Also another fragment (C52519/18698) appears to be retouched along one edge. It is, however, difficult to determine whether it was originally part of a vessel, a convex mount, or a window pane.

Site Period II:2

Sub-phase 2 is only represented on Plots 2A, 2B, 3A and 3B. On Plot 1A, any horizontal layers originally deposited at this time have been ploughed away. Twenty-six vessel-fragments and one inlay made from a vessel- or window-fragment have been

Description/Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Very light green-blue funnel beaker	7 (9–10)	1	SF 12	C52519/18812, C52519/18682–3 (melted rim), C52519/40317–9, C52519/27074
Very light green-blue funnel beaker	1	-	SF 12?	C52519/20997
Undiagnostic, very light blue-green vessel, marvered white trails and bichrome twisted trail	1 (4)	1	SF 1	C52519/21443
Very light blue-green funnel beaker	1 (2)	1	SF 24	C52519/24556 (rim)
Light yellow-green ?funnel beaker	3 (3–4)	1	SF 13	C52519/40320, C52519/18655 (rim) C52519/28187
Very light yellow-green vessel	2	-	SF 13 or SF 5	C52519/28087, C52519/28104
Residual fragments of very light yellow-green cone or funnel- shaped beaker, white marvered trailing	3 (10–13)	-	SF 5	C52519/40322, C52519/21524, C52519/19666
Undiagnostic, very light green vessel	1	-	Not allocated	C52519/18322 (heat exposed)
Light green ?funnel beaker, horizontal white trailing	1	1		C52519/21045 (rim)
Matt light green funnel beaker, white vertical marvered trailing	1 (3)	1	SF 9	C52519/17215 (base)
Undiagnostic, dark blue-green vessel	1	1		C52519/27356
Undiagnostic, colourless yellow-green vessel	1	-	Not allocated	C52519/23153 (very thin fabric)
Undiagnostic, very light blue vessel	1	-	Not allocated	C52519/18469
Residual fragment of nearly colourless vessel, yellow marvered trail	1 (8–11)	-	SF 10	C52519/16582
Residual fragment of very light green-blue funnel beaker	1 (4)	-	SF 16	C52519/11341
Light blue-green inlay	(1)	-	Not allocated	C52519/27578
Total	26	7		

Table 9.9 *Sherd Families represented in SP II:2. NVF = Number of fragments. The total number of fragments from all Site Periods associated with the Sherd Family in brackets; EMN = Estimated minimum number of vessels; Not allocated = Fragments with undiagnostic matrix or fragments that might represent glassmaking cullet or other secondarily utilised material, which have not been included in the calculation of estimated minimum numbers of vessels. For information on individual Sherd Families, see Appendix 9.3.*

uncovered from the SP II:2 deposits (Tab. 9.9). They represent an estimated minimum number of six vessels. One of the vessels (SF 5) is sherd-linked with a series of vessel-fragments from deposits allocated to SP II:1. This could imply that the site phasing may not always be 100% reliable, but is more likely to give an indication of the level of redeposition on the site.

There is a marked concentration of finds on Plots 3A and B, and in layers associated with buildings A301 and A302 where remains of several funnel-shaped or tall beakers appear to have been in use and subsequently broken (Fig. 9.29). Three of these vessels were decorated with marvered white trailing. Although there are relatively few actual sherd-links, compositional analyses confirm that many individual vessels (e.g. SF 5 and 12) are represented by a considerable number of fragments. Some of these have been recovered from the accumulating occupation layers while other fragments lay in ditches and pits towards the edges of the plots. They undoubtedly represent vessels broken in the buildings. While most glass fragments were likely to have been removed at once, a small number of sherds must have remained on the floor and been trampled into the occupation deposits. These vessel-fragments are generally smaller than the finds from the surrounding waste deposits (cf. below, 9.2.6).

Despite the preservation of horizontal SP II:2 layers on Plot 2A no building remains could be established in this area, and the plot may temporarily have been abandoned or used for tents or other lighter constructions. The increased accumulation of refuse on the plot (Pilø et al. 2003:78) may indicate that the available space was used to dump waste. This is a familiar phenomenon in other contemporary urban communities (e.g. Malcolm et al. 2003:162–4). However, no such tendency is reflected in the glass assemblage. Only four vessel-fragments can be associated with the Plot 2A deposits, and these are neatly positioned to the side of the plot leaving any occupational space free of glass.[8] The vessels may alternatively represent refuse from the neighbouring plots. C52519/16582 is probably residual, while C52519/18322 is a near plane fragment that

Figure 9.29 *Distribution of vessel glass in SP II:2. Sherds from SF 1, 5, 9, 10, 12, 13, 16, 24 are indicated (Tab. 9.9). Map, Elise Naumann.*

has been exposed to secondary heating. Two other sherds have been recovered from the south-eastern end of the plot, close to the midden area in front of the plots. One (C52519/17215, SF 9) is the base of a dull light green funnel beaker decorated with vertical marvered trails.

Glassworking debris and material primarily associated with glassworking is also concentrated upon Plots 3A and 3B in this sub-phase (24 of 34 fragments are from this area). It should, however, be noted that no workshop remains have been established and that micromorphological analyses of the deposits argue against the use of the building on Plot 3A as a workshop. Most of the raw materials recognised derive from Plots 2A and 2B. The SP II:2 glassworking waste from Plots 3A and 3B therefore appears to be residual (below, 9.4.2).

8 Plot 2B, possibly used by the inhabitants as an animal pen or a pig sty, would also have been an obvious place to dispose of waste – albeit only food waste and organic materials, not glass.

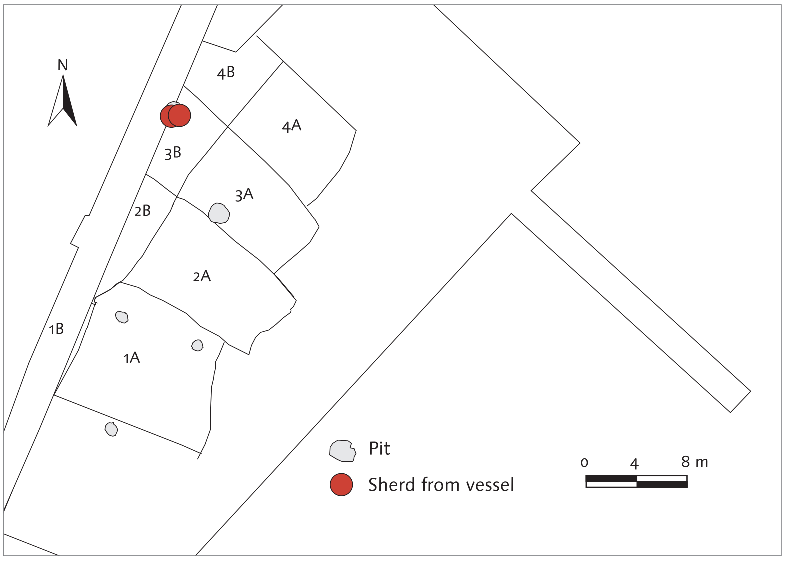
Description/Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Very light blue-green funnel beaker, green-blue *in calmo* rim	1 (2)	1	SF 6	C52519/22663
Residual SP I–III vessel	1 (3)	1	SF 23	C52519/27464
Total	2	2		

Table 9.10 *Vessel glass from SP III. NVF=Number of fragments (total number of fragments from all Site Periods associated with the Sherd Family in brackets); EMN=Estimated minimum number of vessels. For information on individual Sherd Families see Appendix 9.3.*

Site Period III

In the MRE area, SP III is constituted of negative features cut into the preserved deposits below. With the exception of some demolition layers covering the SP II:2 building remains on Plot 3B (Pilø et al. 2003:115), any horizontal layers accumulated in this period have been ploughed away. The finds are few, and largely derive from the backfill of the large pits A43852 on Plot 3B and A65446 on Plot 3A (Tab. 9.10, Fig. 9.30). C52519/27464 is from a nearly colourless vessel with thin white trailing (SF 23). A second fragment from this vessel was recovered from the deposits east of Plot 4A, but this cannot help us to be more precise about when the vessel was in use on the site. A section of a green-blue *in calmo* rim from a funnel beaker (C52519/22663) should also be noted. This links to C52516/2705 (SF 6) from the overlying later medieval plough-layer. Whether the SP III sherds can be connected to any of the vessels represented in SP II is difficult to establish.

Only small amounts of residual glassworking debris were recovered on Plots 3A/B and 1A in SP III. On Plot 1A, these are mainly from the fill of post-holes cutting SP II:1 deposits. No glass of any description was uncovered from the deposits on Plot 2A/B in this Site Period.



Vessel glass in Viking-period strata close to the phased plots

A number of glass fragments have been recovered from structures that can be related to Viking-period activity, but with no stratigraphical connexion to the phased plots or in locations where this relationship cannot be reconstructed. The phasing of the material follows the definitions in Pedersen and Pilø (2007:184–6). Briefly, this means that the large group of finds from the area adjacent to the phased plots in the CRM trench and from Plots 4A and 4B of the MRE area (Fig. 9.31) are attributed to SP I–III. Finds made further north and east of plots 4A and 4B cannot be correlated with the site phasing ("Without SP"). Also "Without SP" is the glass from the CRM trench north of the main excavation (Fig. 9.33). This group has been collected from a large area and from deposits that are diverse in character and often limited in extent also. It can therefore be difficult to gain a meaningful insight into what the glass finds represent and how representative they are of the activities in the various parts of the site they come from. Consequently only the most characteristic attributes of these finds will therefore be discussed here.

About 40 m of the CRM trench excavated in 2000 run adjacent to the MRE area. The deposits were predominantly excavated in mechanical spits, and it has proved difficult to relate the information on contexts to the established stratigraphy of the research excavation. It is, however, likely that the deposits below the later medieval plough-layer are of a comparable, early 9th-century, date to the adjacent phased plots (Pilø et al. 2000:75–88).

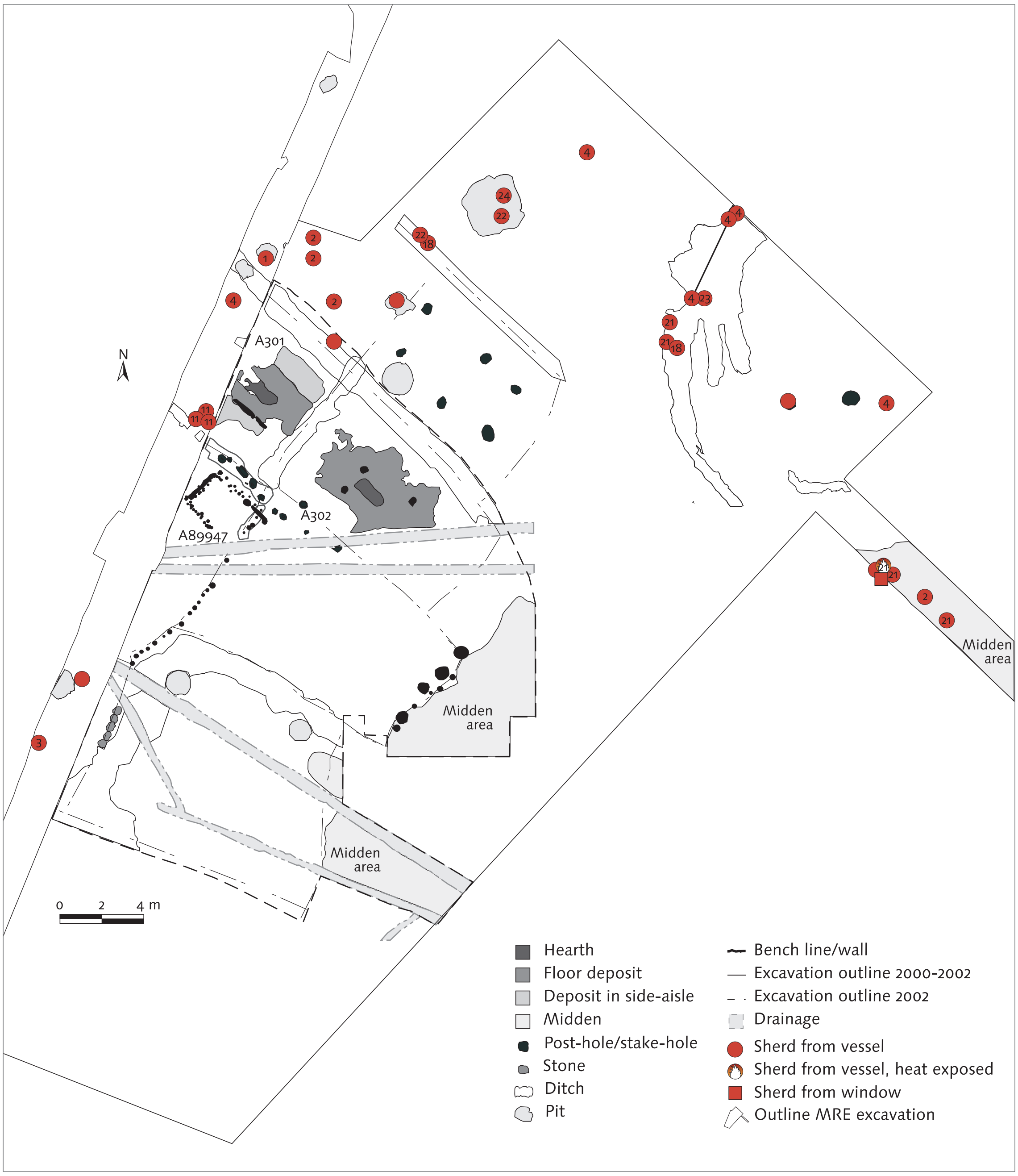
Two sherds have been recovered from Plot 1B (Tab. 9.11). One fragment of a marbled red jar comes

Figure 9.30 *Distribution of vessel glass in SP III (Tab. 9.10). Map, Elise Naumann.*

Figure 9.31 *Distribution of glass in the area north and east of Plots 3A and 3B. Sherds from SF 1–4, 11, 18, 21–3 are indicated (Tabs. 9.11–14). Map, Elise Naumann.*

Description/Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Red streaked jar, white trailing	1 (10)	-	SF 3	C52516/3869
Undiagnostic, medium brown-green vessel	1	1		C52516/3035
Very light blue-green funnel-shaped/cone beaker.	3 (3–5)	1	SF 11	C52516/3162, C52516/6383, C52516/6384.
Very light yellow-green funnel beaker, reticella-decorated rim	1	1		C52516/3188
Very light blue-green vessel, white trailing	1 (7–8)	1	SF 4	C52516/6382
Very light blue-green jar, reticella decoration and trailing	1 (4)	1	SF 1	C52516/4537
Total	8	5		

Table 9.11 *Vessel-glass finds from areas corresponding to Plots 1B, 3B and 4B in the CRM trench. No finds were made on Plot 2B. NVF=Number of fragments. Total number of fragments from all Site Periods associated with the Sherd Families in brackets; EMN=Estimated minimum number of vessels. For information on individual Sherd Families see Appendix 9.3.*



Description/Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Undiagnostic, medium blue vessel	1 (4)	-	SF 18	C52519/9754
Red streaked jar, white trailing	3 (12)	-	SF 2	C52519/11391, C52519/11962, C52519/11999
Very light blue-green funnel beaker, blue applied rim	1	1		C52519/12022
Undiagnostic, very light yellow-green vessel, yellow trails	1	1		C52519/6206
Undiagnostic, medium yellow-brown vessel	1	1		C52519/11415
Undiagnostic, light green-blue vessel, matted and layered	1 (2)	1	SF 22	C52519/9751
Total	8	4		

Table 9.12 *Vessel glass from Plot 4B. MRE excavation 2001. NVF=Number of fragments. Total number of fragments from all Site Periods associated with the Sherd Family in brackets; EMN=Estimated minimum number of vessels. For information on individual Sherd Families see Appendix 9.3.*

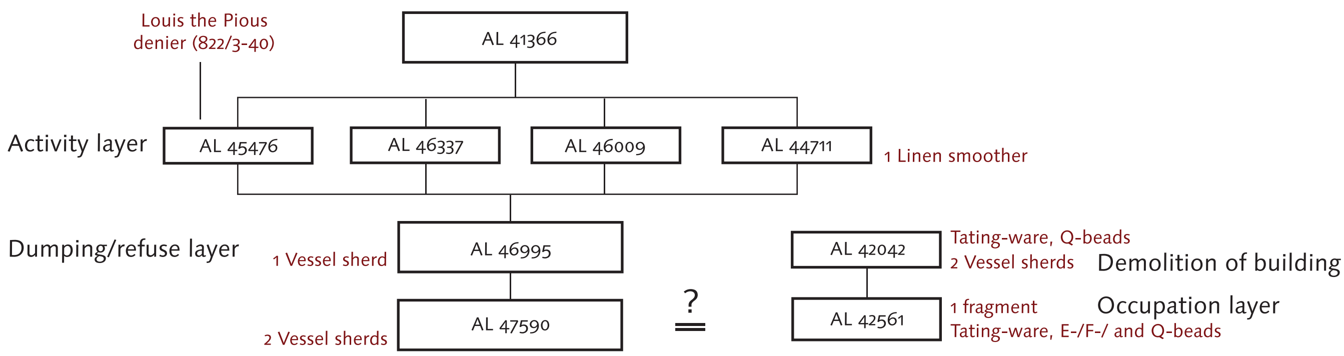
from a charcoal layer in what is interpreted as a workshop. This sherd must be associated with SF 3 (see discussion of SP II:1 above). Another undiagnostic, medium brown-green vessel-fragment belongs to the same settlement phase (Pilø et al. 2000:83).

Further north-east, four sherds are from the segment of the trench crossing Plot 3B. Three fragments from a conical or funnel-shaped beaker (SF 11) were recovered from a shallow pit, A11958. Possibly the pit had been used to dump refuse. A similar structure (A82649) was also uncovered further east, covered by building A303 on Plot 3B (MRE). A rim sherd from another funnel beaker decorated with a reticella cable (9.2.3) was recovered from a linear drystone structure (A8797) excavated below A100 closer to Plot 4B. Just inside the latter plot, two further vessel sherds were recovered. One of them is a very large fragment from a jar or small bowl decorated with white reticella and trailing (SF 1). Unfortunately, the archaeological interpretation is unclear here (Pilø et al. 2000:88–9) and it is difficult to get a clear understanding of the context and its stratigraphical position.

We are in a slightly better position to judge the stratigraphy from the area directly north of Plots 3A and 3B, where research excavations were started in 2001. Although the work was not carried through down to the subsoil in 2002, the layout of two plots, 4A and 4B, is roughly known. A number of finds were made in layers interpreted as floor accumulations on Plot 4B (Fig. 9.32, Tab. 9.12). It is clear that these deposits should be associated with SP II, but not whether they are contemporary with SP II:1 and II:2 on Plots 3A and 3B or connected to a later subphase only preserved on Plot 4B.

The excavated layers represent at least two "phases" of activity, separated by a series of refuse and/or demolition layers. Noticeable is the find of a Louis the Pious denier of "XPRISTIANA RELIGIO" type in the youngest of these horizons. Coins of this type have a terminus post quem of AD 822, and are assumed not to have reached Scandinavia after about 840 (Blackburn 2008). The other small finds, amongst them Tating-ware pottery and glass beads, *indicate* that the sequence of deposits should be dated to the second to fourth decade of the 9th century (Gry Wiker, pers. comm.).

Figure 9.32 *Harris matrix of deposits excavated on Plot 4B in 2001 with vessel glass and other associated finds superimposed. Illustration, Elise Naumann.*



Description/Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Very light blue-green funnel beaker or jar, white trailing.	2 (7–8)	-	SF 4	C52519/11818, C52519/11646
Undiagnostic, light green-blue matted and layered vessel	1 (2)	-	SF 22	C52519/11822
Total	3	-		

Table 9.13 *Vessel glass from the area north of Plot 4A. NVF=Number of fragments. Total number of fragments from all Site Periods associated with the Sherd Families in brackets; EMN=Estimated minimum number of vessels. For information on individual Sherd Families see Appendix 9.3.*

Description/Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Undiagnostic, very light blue-green vessel, white trailing.	4 (7–8)	2?	SF 4	C52519/9959, C52519/10136, C52519/12329, C52519/40706
Undiagnostic, medium blue vessel	1 (4)	-	SF 18	C52519/15063
Red streaked jar, white reticella and trailing	1 (12)	-	SF 2	C52519/9925
?Funnel beaker, double green-blue and colourless applied rim	1	1		C52519/9661
Undiagnostic, colourless (yellow-green) vessel	1	-	SF 23	C52519/9725
Very light green-blue funnel beaker	3	1	SF 21	C52519/10092, C52519/9929, C52519/12315
Undiagnostic, colourless (green) vessel	1	-	Not allocated	C52519/12237
Undiagnostic, light blue vessel	1	-	Not allocated	C52519/2355
Undiagnostic, colourless vessel or window	1	-	Not allocated	C52519/40321 (exposed to heat)
Total	14	4		

Table 9.14 *Vessel glass from the area east of Plot 4A and in the midden area towards the beach. NVF=Number of fragments. Total number of fragments from all Site Periods associated with the Sherd Families in brackets; EMN=Estimated minimum number of vessels. For information on individual Sherd Families see Appendix 9.3.*

Fragments from two different glass vessels can be associated with the oldest of the *excavated* occupation events: a light blue-green funnel beaker with a blue applied rim (C52519/12022) and a red streaked jar decorated with a thick white trail around the neck (SF 2). Two further sherds associated with SF 2 and a third light yellow-green vessel with opaque yellow decoration (C52519/6206) are from layers interpreted as demolition and levelling events above the occupation deposits. It therefore seems reasonable also to relate these finds to the lower occupation level.

In the fill of the trench north-east of Plot 4B two disparate fragments (tentatively associated with SF 18 and 22) were recovered.

There are some uncertainties with regard to the quantification of fragments belonging to SF 2 (SP II:1 above) and SF 4 (below). Including the two sherds from the CRM trench discussed above, however, six or seven vessels may be represented on Plot 4B, and could have been in use in or around the building(s) here. It is worth noting that several fragments of Tating-ware pottery were uncovered with the glass in lower occupation horizon (AL42561 and AL42042) and that the Plot 4B assemblage also includes fragments of two glass linen-smoothers (below, 9.3.2).

Finds from the area *north of Plot 4A* (Tab. 9.13) are more difficult to place stratigraphically, and must be considered "Without SP" (Pedersen and Pilø 2007:186). Although preserved horizontal settlement deposits were uncovered here, few of these were excavated. Glass finds derive mainly from a depression covering a large pit. The finds are likely to be redeposited and contribute little to the understanding of the use of vessel glass on the plot.

In the area *east of Plot 4A* the modern ploughsoil directly overlay the natural gravel/sand, and only features cutting into the beach ridge – most notably a number of post-holes and an arched depression (AL20665) interpreted as a plot-boundary ditch – were preserved. Within the fill of this latter feature, at least two sherds of a light green-blue vessel with marvered white wave-lines and horizontal white trailing were uncovered (SF 4). The many sherds of similar light green-blue colour with applied white trailing from the same general area of the settlement indicate that several additional fragments should be associated with this group. Exactly how many, however, is difficult to establish with certainty. Particular note should be made of a sherd from what

Description/Vessel-type	NVF	EMN	Sherd Family	Inventory nos. and notes
Light blue-green vessel or window	1	-		C52516/4148
Undiagnostic, light green vessel	1	1		C52516/3616 (heat exposed)
Undiagnostic, light green vessel, yellow marvered trailing	1	1		C52516/3712
Undiagnostic, very light purple-brown vessel	1	1		C52516/3532
Undiagnostic, light grey-green vessel	1	1		C52516/3538
Very light grey-green funnel beaker	1	1		C52516/4229 rim
Very light green-yellow cylindrical shaped/cone (funnel) beaker.	1	1		C53160/532 rim
Light green-blue thick walled vessel	1	1		C53160/534
Total	8	7		

Table 9.15 *Vessel finds from the CRM trenches and the Harbour excavation north of the MRE site.*

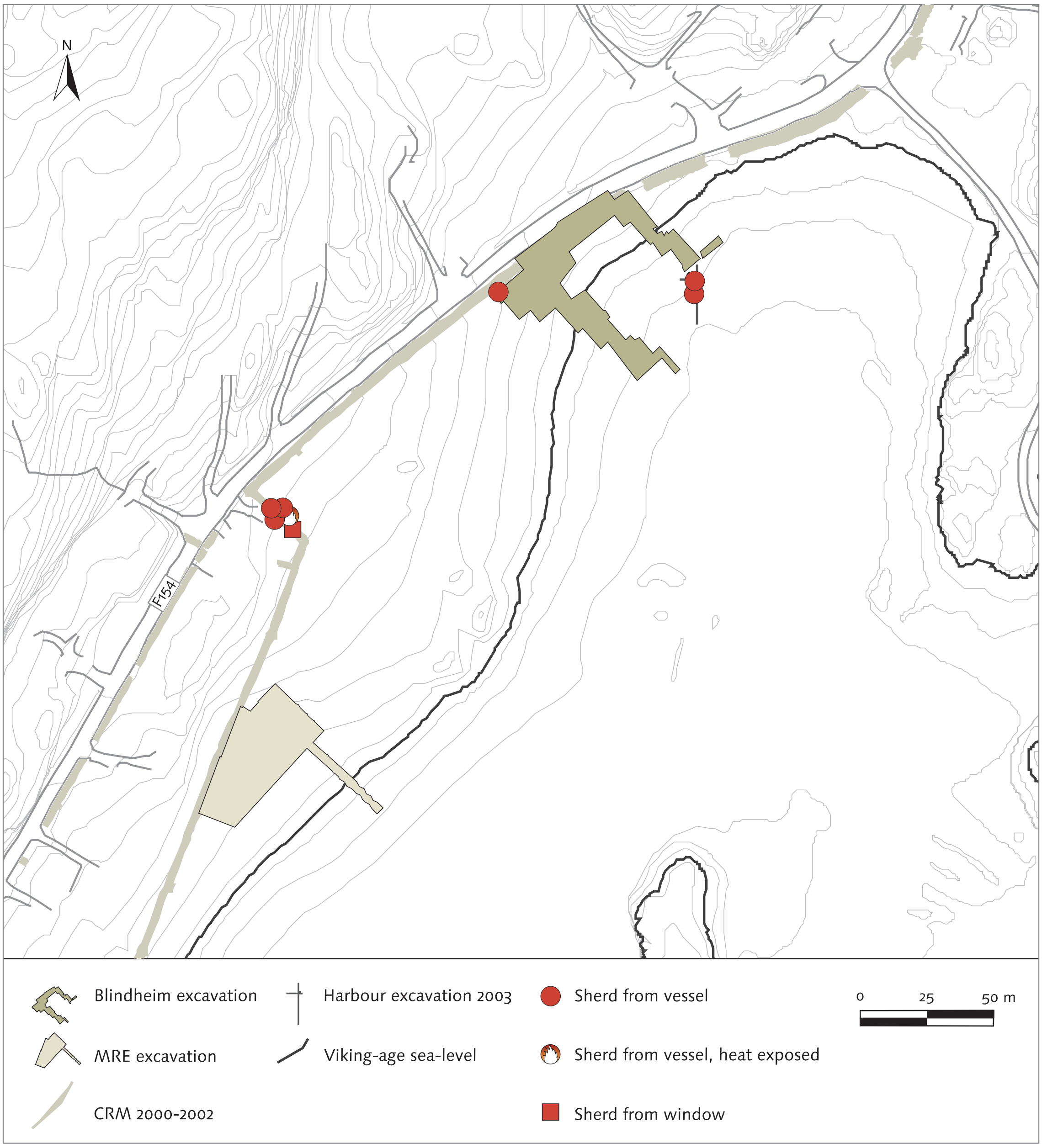


Figure 9.33 *Distribution of glass in the CRM trench north of the MRE excavation. Map, Elise Naumann. Although only a single vessel sherd (C52516/4229) has been recovered from the CRM trench along the municipal road, Blindheim's excavations in 1956–1974, as well as the 2003 harbour excavations, testify to the presence of vessel glass in the northern part of the settlement area too. It is likely that the variations in recovery reflect the position of the trenches in relation to the Viking-period shoreline and (primarily) the absence of preserved cultural layers. Contour interval 1 m.*

Figure 9.34 *A graduated representation of sherd length of stratified vessel glass. Map, Elise Naumann*

appears to be a funnel beaker with a double applied rim (Type 6c; 9.2.2–3).

Four sherds were uncovered from dumping layers uncovered in the narrow trial trench south-east of the main excavation area, towards the Viking-period shoreline. In comparison, only a single fragment of vessel glass comes from the midden area in front of Plots 1A, 2A and 3A, although the latter area was not completely excavated. Amongst the finds from the trial trench is a rim sherd from a red streaked jar (SF 2) associated with other fragments uncovered on Plot 4B, and two fragments of what is most likely a green-blue funnel beaker (SF 21).

In the CRM trench both north and south of the MRE excavation area the finds diminish rapidly due

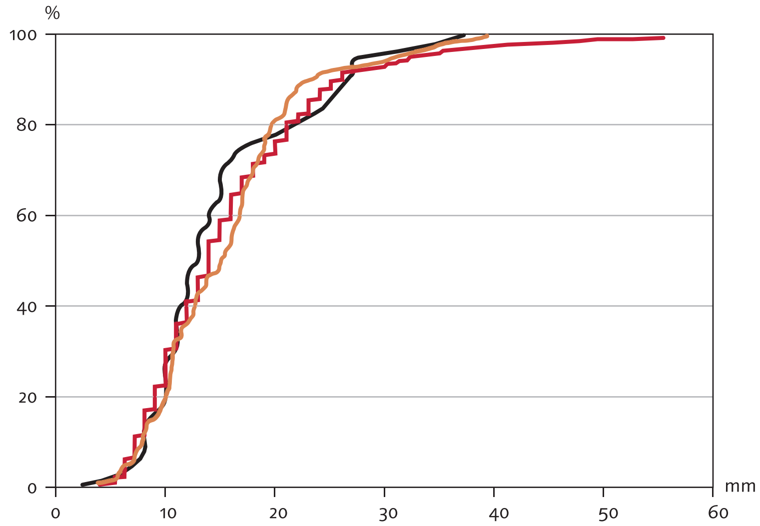


Figure 9.35 *Cumulative frequency diagram showing the size of vessel-fragments in the stratified Viking-period deposits at Kaupang (orange line). The steep rise between 5 and 22 mm represents nearly 90% of the assemblage and illustrates the high degree of fragmentation. Comparative material from, London (Royal Opera House, black line) and Ribe (Nicolajgade 8; ASR7 and ASR 621, red line) from Stiff 2003:342–3, fig. 154.*

Figure 9.36 *Distribution of fragments from SF 3 and 5, SP II:1. Map, Elise Naumann.*

to the lack of preserved layers (Tab. 9.15, Fig. 9.33). There is one cluster of finds in an area of building remains uncovered in 2000 on the central plateau of the site (Pilø 2007c:167–8). Although many of the glass finds derive from the backfill of one large pit (A9062), the matrix of the vessel sherds is so heterogeneous that none can be from the same object and it is impossible to say if the sherds represent complete vessels in use or scrap glass. A further concentration of glassworking waste is located south of the curving municipal road where stone revetments similar to those seen at the east end of Plots 2A and 3A were recorded (Pilø 2007c:168–9).

9.2.6 Patterns of use and waste disposal

The preceding part of this chapter has detailed the chronological and spatial distribution of vessel glass in and around the excavated plots at Kaupang. Considerable effort has been made to explore the relationship between fragments from morphologically different groups of glass (Sherd Families) and to understand the distribution patterns they form. Altogether, this suggests the original number of glass vessels present (the live assemblage) and further suggested how the vessels were used, broken and discarded on the site. What follows is a presentation of the cumulative observations made during this investigation (for further details, see Appendix 9.3).

Fragmentation frequency

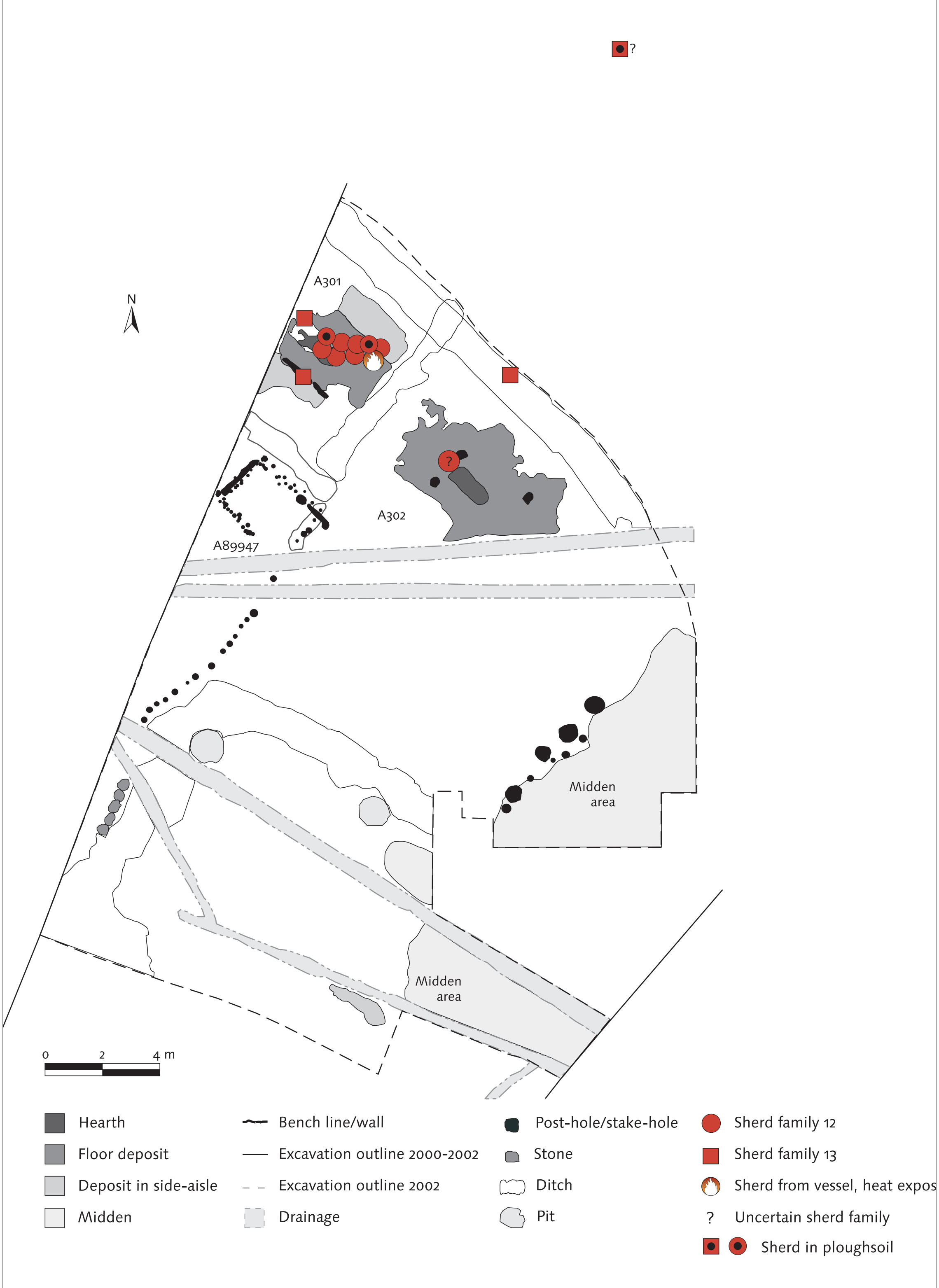
Based on the assumption that the fragment size will reflect the level of activity and trampling (Campbell 1991:50–70, with refs.; 9.2.4), attempts have been made to explore the correlation between different deposits and sherd-size in the stratified MRE-sample (Fig. 9.34). Despite the low frequency of finds, the results reveal some *tendencies* in vessel distribution. They can be used to support and qualify many of the conclusions drawn from the character of the deposits and other artefact-groups on the subject of activity zones and site-formation processes at Kaupang.

There is generally a lower frequency of vessel sherds in the central areas of the plots, and the fragments associated with building floor layers are small in size. There are notable exceptions, such as the relatively large SF 2 fragments from Plot 4B. Nevertheless, most of the large sherds come from pits or were found close to plot-boundary ditches where less activity, or the rapid accumulation of refuse layers, are likely to have restricted trampling. An obvious example is the three linked fragments from SF 1 that make up about 25% of the circumference of a reticella-decorated jar. Only a few sherds appear to have been permanently protected in this way, however, and pit-contexts and ditches also contain some exceptionally small sherds. Many of these fragments must represent secondary or tertiary deposits exposed to breakage on a different part of the site. Analyses of ecofacts from waterlogged pit deposits have, for example, revealed that many pits contained redeposited floor material (Barrett et al. 2007:297–8). The presence of secondary or tertiary redeposited glass in the pits is demonstrated by vessel sherds and production waste from the A43852 (SP III, Plot 3B) which join with fragments from other parts of the site.

Overall, the vessel sherds from Kaupang are highly fragmented (Fig. 9.35). Compared with sieved sample assemblages from Ribe and the *Royal Opera House*, London, the proportion of fragments <20 mm in the stratified deposits at Kaupang is similar or even higher. Although this could theoretically reflect a slow build-up of the protecting deposits, it is more likely to indicate very intensive occupation at Kaupang, with at least some of the material having been subject to several cycles of redeposition and trampling.

Spatial patterns

Looking in closer detail at the individual sherds, it is likely that the spatially and morphologically discrete material groups that have been identified largely represent complete vessels that were in use on the site. Fragments from 24 Sherd Families of several identifiable pieces (N=123) have been recorded: 22 from the MRE excavations. The large number of undiagnostic light green and blue sherds that have not been allocated to Sherd Families, however, indicate that the total *estimated minimum number* of vessels broken and deposited on or around the excavated plots in the period c. AD 800–840/50 must have been higher (for a statistical extrapolation on the total circulation of vessels and a discussion of the social context of consumption, see below, 9.5–5.2). A small proportion of the glass *may* also have been imported as fragmentary cullet for glassworking (see further below). That this was a large part of the assemblage is unlikely, though. Although several sherds from individual vessels could theoretically have been collected and imported together to Kaupang in a cargo of cullet,[9] it is unlikely that such fragments would also be deposited together and form parts of meaningful spatial patterns.

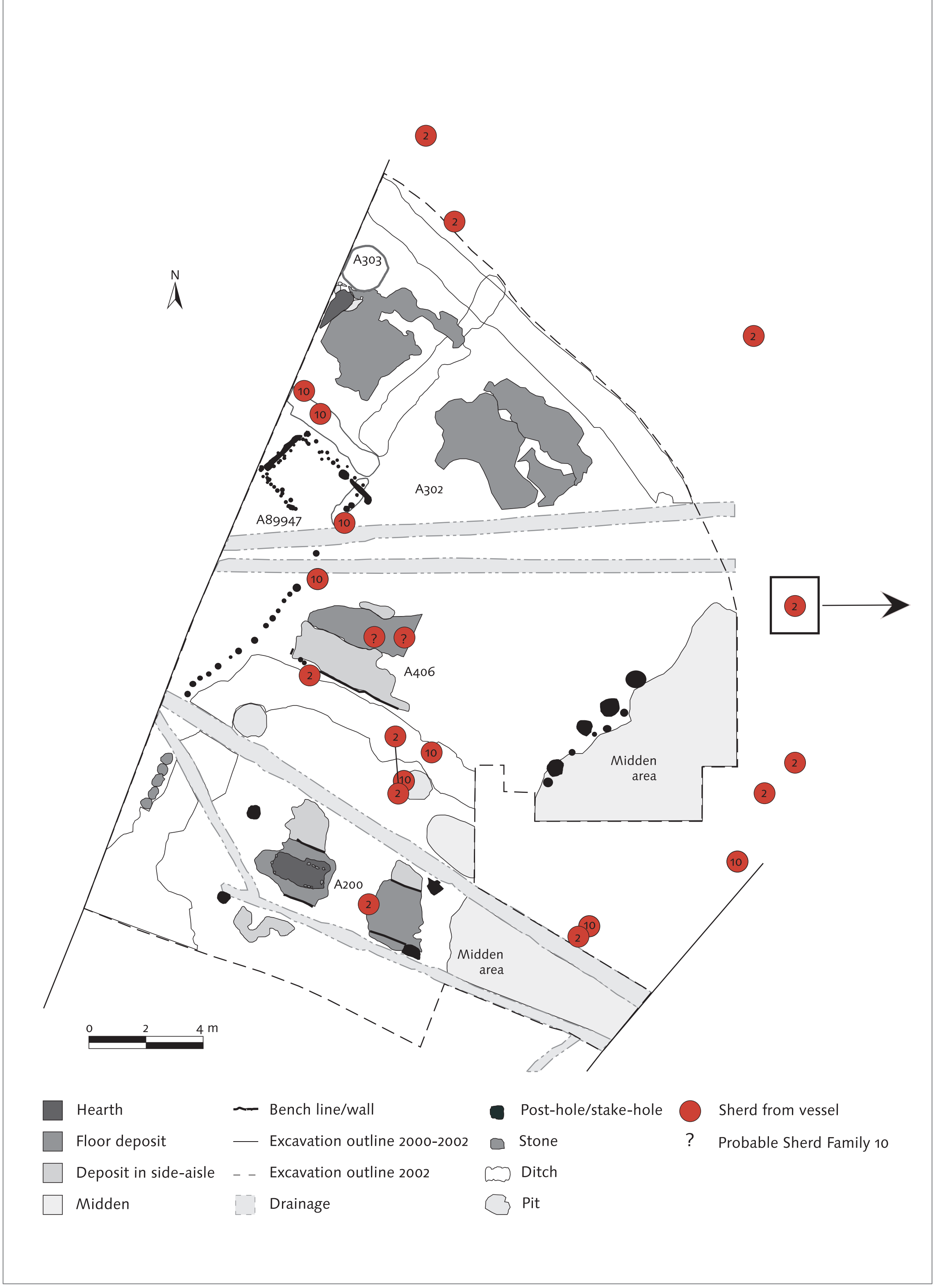


The majority of sherds appear to have been deposited outside the excavated buildings: to the side of the plots, along fence lines, or in small pits or ditches dividing the plots. Sherd links or vessels associated with individual Sherd Families are often found in discrete clusters (e.g. SF 1, 3 and 5), or around the perimeter of the plots (Fig. 9.36). This is particularly apparent in the case of glass associated with the SP II:2 deposits on Plots 2A, 3A and 3B.

It is reasonable to view the material uncovered outside the buildings as from artefacts removed from activity or living spaces where they had been in use when broken, to be left in primary discard areas

Figure 9.37 *Distribution of fragments from SF 12 and 13. The finds are predominantly from floor deposits within building A301, Plot 3B, SP II:2. Map, Elise Naumann.*

Figure 9.38 *Distribution of sherds belonging to SF 2 and SF 10. Although some sherds are recovered from floor deposits within buildings A200 and A406 and the floor layer AL47590 on Plot 4B, the majority of sherds are widely scattered. Map, Elise Naumann.*



immediately outside. Glass, in particular, is likely to have been removed quickly because of its high nuisance factor (Hayden and Cannon 1983; Schiffer 1987) – or at least those sherds one could immediately locate. Micromorphological analyses of floor deposits inside building A301 on Plot 3B indicate that they had been swept or truncated periodically (Milek and French 2007:340; cf. Barrett et al. 2007:296–8) and that some refuse was removed in this manner. A similar inference was also made by Näsman from the distribution of vessel glass from the fortified settlement of Eketorp-II on Öland (1986:58–62, fig. 3).

Due to the constant recutting of features and periodical levelling of plots at Kaupang prior to the establishment of new buildings, this spatial pattern is best observed where associated with the later building phases. The effect of digging and redeposition has been particularly noted in the case of

9 This is illustrated, for example, by the metric tonne of broken vessel glass recovered together with two tonnes of raw glass from the Serçe Limani shipwreck: Bass 1984; Bass et al. 2004:268. See also the Serçe Limani Shipwreck Excavation web-site at http://ina.tamu.edu/SerceLimani.htm

Figure 9.39 *The relative density of finds of vessel glass in Blindheim's excavation trenches represented by shades of colour (for the location of the trenches, see Pilø and Skre, this vol. Ch. 2: Fig. 2.4). The lowest density (lightest shade) is 0.3 per 2 m square and the maximum (darkest) 4.9 per 2 m square. The assessment is based on an unpublished find-list by Ellen Karine Hougen (n.d.) and the finds are plotted on the published excavation grid (Tollnes 1998:pl. 3). No evaluation of the vertical position of the finds within each square has been possible. It is therefore not known how many sherds were recovered from undisturbed Viking-period contexts and how many are from the later medieval plough-layer. However, the horizontal movement caused by medieval ploughing is not believed to have been extensive (Pedersen and Pilø 2007:186; further below, 9.2.7). Contour interval 1 m.*

fragments of SF 5 with finds deriving from what are considered intrusive SP I deposits (Plot 2A), SP II:1 deposits on Plots 2A and 3A, SP II:2 deposits on Plots 2A and 3A, and SP II:2 deposits on Plot 3A.

Occasionally, redeposited sherds have also been recovered from contexts interpreted as levelling layers above buildings (e.g. on Plot 4B; 9.2.5, Fig. 9.32), or in the backfill of pits (e.g. A43852, SP III, Plot 3B). Smaller finds, like beadworking waste, could become mixed with the construction material for hearths (e.g. A62544 [SP II:2, Plot 2A] and A64768 [SP II:2, Plot 3A]).

A much smaller number of finds has been uncovered from primary floor deposits (e.g. SF 12 and 13 and certain fragments from SF 2 and 10; Figs. 9.37–8). These sherds are generally much smaller in size, which probably led to their being overlooked in the first place as well as being a reflex of the continuous trampling they were exposed to. These tiny fragments were eventually embedded in the floor matrices.

Comparative material

The patterns of distribution described above can be compared with what is known from medieval Bergen (Økland 1998; Hansen 2005:48–50; Høie 2006). Kristine Høie has analysed the vessel glass deposited in periods 3–8 (AD 1170–1702) at the *Bergen Wharf*. She concludes (2006:59–77) that broken glass was not regarded as a resource to be retained or collected, but was removed from the houses in which it had been used and disposed of. All the earliest glass finds (periods 3–5) are from wells, alleyways, or from the harbour area where rubbish was dumped, first for convenience, and later deliberately to create new land. It is, however, worth noting that neither Høie nor Gitte Hansen (2005:48–50), who have analysed other refuse deposits in Bergen predating 1170, could identify concentrations of waste in the boundary zones between plots (beyond what was found in the alleyways). This is in marked contrast to the pattern of deposition observed at Kaupang and in many other Early-medieval coastal market towns (e.g. Hamwic: Morton 1992:42–3 and 45; York: Kemp 1996:15–27 and 67–71; Lundenwic: Malcolm et al. 2003:162–4), where refuse is often found piled up against fences, or in pits toward plot-edges. A possible explanation is that the Bergen plots were generally larger than their counterparts in Kaupang, providing room for waste disposal *within* the individual yards.

It is also interesting that there are almost no glass finds from the midden area in front of the plots at Kaupang and that no links can be established between this material and the sherds deposited on the building plots. The only exception to this general impression are the sherds recovered in the midden area east of Plot 4A. In contrast, waste, including glassware, was habitually thrown into the sea by the inhabitants of Bergen, well before large-scale land reclamation in *Vågen* began in the 13th century (Høie 2006:76–7). In 10th- and early 11th-century Trondheim too, refuse and building material were used to fill the shallow inlet and the river either side of the early settlement nucleus at *Folkebibliotekstomta* (Christophersen and Noreide 1994:72–3).

One possible explanation is that, although the deposits from Kaupang represent the dumping of household and industrial waste, as the detailed analyses of the ecofacts suggest, most of the household waste came directly from hearths and did not include floor assemblages (Pilø et al. 2003:131–3; Milek and French 2007:353–4; cf. Barrett el al. 2007:297). Deposits swept from floors containing occasional glass fragments appear to have been left in primary discard zones on the plots described above. Larger glass fragments and secondary waste removed from the plots may have been thrown further into the water, beyond the limit of the MRE trenches. To explore this possibility, a brief evaluation was made of the vessel glass finds from Blindheim's settlement excavations, where larger areas below the Viking-period shoreline were excavated. Material from the 2003 harbour evaluations was also considered.

It has been suggested that the structures uncovered by Blindheim in her main excavation area were similar to the stake and stone revetments revealed at the south-eastern (lower) end of the building plots during the MRE excavations (Pilø 2007a, 2007c:169, fig. 8.13, 2007d:211–22). Two trenches (C/D and BO) stretched into the old seabed from this area (Fig. 9.39). Trench C/D continued some 40 m beyond the estimated shoreline to a level about 2 m below Viking-period sea-level (Tollnes 1998:15–17, pl. 2). Of 235 vessel sherds that can be plotted with reasonable accuracy, 54 fragments are from this area and 20 or 21 fragments from squares situated below the estimated shoreline (the lower parts of Tollnes's Brygge II, Phase 1, and below; cf. Tollnes 1998:97–102). There were no recorded glass finds from the lower parts of trench BO (BO1958). One can therefore conclude that the bulk of the glass finds derive from the main building plots well into dry land, parallel to the situation in Skre's MRE excavation, but with a significant minority (9%) from areas that were submerged in the Viking Period. Two water-deposited sherds also came to light in trenches opened just outside Blindheim's trench BO in 2003 (Baug 2004). This spread is unlikely to have been caused by surface run-off alone, and some glass waste thus appears to have been thrown into the water outside this part of the settlement.

It is difficult to establish why comparatively few fragments of glass were uncovered from the midden in front of the settlement in Skre's excavations. It is, however, worth remembering that very small areas in this part of the settlement have been excavated, and that the deposits are not well dated.[10] This gives further reason to be cautious in drawing conclusions. The finds from the trial trench east of Plot 4A were made further east than the MRE generally extended. If glass was generally deposited in deep water rather than in the midden on the beach, this may help to explain why such small proportions of the original vessels have been recovered.

Recovery percentage

It has been possible to relate up to twelve single sherds to individual vessels (Sherd Families), but on average the number of associated sherds is down to four or five.[11] Although the sample assemblage of glass from the stratified deposits at Kaupang is likely to be very similar to the assemblage first deposited, the modest recovery rate of glass fragments indicates that the excavated material represents only small amounts of the vessels in the live assemblage. This is a common feature of Early-medieval glass assemblages (Campbell 2000:33; Stiff 2003:242; Lund Feveile 2006:231–4), and can tentatively be explained by a number of factors. These highlight the "open" character of the system of waste disposal likely to have been in place at Kaupang, and emphasizes that glass related to the activities studied here was also inevitably deposited outside the limits of the excavated area.

Firstly, ethnographic analogies (e.g. Hayden and Cannon 1983; Schiffer 1987:58–72), as well as general considerations concerning population density and the limited space available on the site, suggest that material deposited in provisional discard areas around the houses must periodically have been removed to more permanent dumps or middens. The inhabitants of medieval towns were concerned about the accumulation and clearance of waste (e.g. Keene 1982; Andrén 1986; Økland 1998:57–117). Documentary sources record attempts to regulate both what the inhabitants could dispose of and how it was done. The population could be required to clear ditches and thoroughfares of accumulating grime to ensure drainage and facilitate movement. Such efforts are also reflected in the archaeologi-

10 The midden deposits could theoretically date from after the middle of the 9th century, at which point it has been suggested (Blackburn 2008:70; Pilø this vol. Ch. 10:302–3) that the importation of Carolingian material to Kaupang was reduced (for the discussion of post-850 importation of vessel glass, see below, 2.7).

11 Average based on minimum number of associated sherds: 4.2; median: 3. Average based on maximum number of associated sherds: 5.2; median: 4. The difference between maximum and minimum number of associated sherds is the result of uncertainty over the exact number of sherds allocated to each Sherd Family and the number of vessels the Sherd Families represent (see Appendix 9.3).

cal record on several sites (e.g. Økland 1998:57–109; Tagesson 2000:157–71; Malcolm et al. 2003:162–4). At Dinas Powys, for example, the majority of vessel glass was found in gullies where other settlement debris also had been deposited (Campbell 1991, 2000:37).

It is not likely that the clearing system at Kaupang was particularly sophisticated, but one should perhaps imagine periodic clearing of accumulated debris combined with the levelling of the parcels and spreading of sand (Milek and French 2007:333–52). The periodical recutting of plot-boundary ditches observed at Kaupang should perhaps be seen in this light. No large-scale "communal" midden deposits containing glass have yet been identified or excavated. As noted above, the excavated midden area outside the building plots contained almost no glass, although some vessel glass may have been deposited in the water beyond (cf. Blindheim's excavation area). Although in a few cases glass has been recovered from small pits or refilled wells, the absence, from Kaupang, of the large rubbish pits frequently seen on Middle Anglo-Saxon sites like Eoforwic, Flixborough, or Hamwic is noticeable (Morton 1992:42, 45; Kemp 1996:67–9; Andrews 1997:174–87; Loveluck 2001). In later medieval Bergen and Oslo, glassware was frequently deposited in wells, possibly while they were still in use (Høie 2006:60–77; Schia and Wiberg 1979:107). Nor was the unbuilt space on Plot 2A in SP II:2 at Kaupang used to dump glass waste, although the excavators noted an increased accumulation of other refuse here at this time (9.2.5). Material from any large-scale clearing was evidently discarded further away from the excavated parts of the settlement.

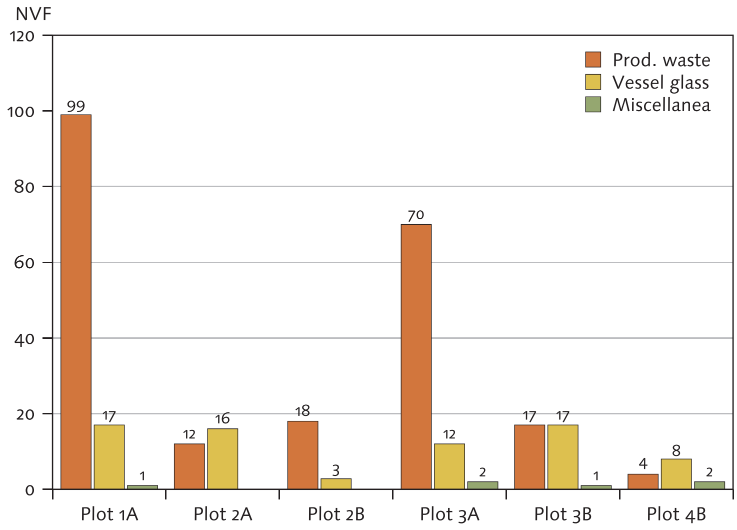
Secondly, any large fragments of a vessel remaining after it had been broken could have been removed individually because of their higher nuisance factor, and because they are easily picked up by hand (as opposed to the contents of most floor-sweepings). This might, for example, explain why so few funnel-beaker bases have been recovered at Kaupang. Conventional considerations would otherwise suggest that these thick and durable vessel parts should have survived well on site. Such objects would also be the more likely objects of children's play. This is one of many randomising factors affecting artefact distribution (Hammond and Hammond 1981; Hayden and Cannon 1983:132–3).

Finally, it is conceivable that some of the material was picked out prior to deposition because of its recycling value, either through the collection of cullet for export or directly though reworking into glass beads (Cool and Price 1995:224–6; Gam Aschenbrenner 1999; Sode 2002; Lund Feveile 2006:237–40). The collection and recycling of glass has been documented on other Early-medieval trading sites (e.g. Mortimer and Heyworth 2004; Pöche 2005:170), and the procurement of broken glass as a raw material for beadmaking has been suggested as a reason for the presence of large vessel-glass assemblages outside the region of production or perceived use (Alcock 1963:52–3; Hougen 1969a). At the *Posthus* site, vessel glass can be indirectly associated with the beadmaking workshops active in phases C–E (c. AD 725–790). The material has therefore *predominantly* been regarded as imported cullet (Lund Feveile 2006:240). Nevertheless, there was probably also a parallel, low-level importation of complete vessels for use by the inhabitants, which continued in phases F–I (c. AD 790–850) despite the contemporary decline in glassworking. At Kaupang, where the frequency of beadmaking is generally lower, and the number of recovered sherds per vessel is significantly higher, it appears to be primarily the use of drinking vessels that is reflected in the assemblage. This obviously does not exclude the occasional importation of cullet or attempts to recycle glass from vessels broken on site (further below, 9.4.1–3). It should nevertheless be noted that the number of vessel-fragments marked by secondary heating or contextually associated with glassworking at Kaupang is very small.

It was pointed out above (9.2.5, Tab. 9.6) that the transformation from seasonal to permanent occupation correlates with a numerical increase in the number of glass vessels circulating on the site. Concurrently in SP II:1 and II:2, the proportion of material related to glassworking decreases (Fig. 9.26). This is likely to reflect a shift in activity on the excavated plots, with the fine tableware indicative of a distinct urban consumer profile (below, 9.5.3). I believe that the shift in character was even more pronounced than the figures reveal, since it can be demonstrated that much of the beadworking waste from SP II:2 and SP III is residual and does not reflect contemporary production.

In addition to the chronological development there are also differences between the excavated plots (Fig. 9.40). While the figures presented here are cumulative scores for SP I–III, and the extent to which the plots have been investigated and the level of preserved deposits varies, it is possible to observe significant changes on the different plots over time. These variations are particularly obvious with regard to waste from glassworking, with clear peaks on Plots 1A and 3A suggesting that this was where production took place (below, 9.4.2). The situation is more complex in the case of the vessel glass, with concentrations at certain buildings and Site Periods (A200 Plot 1A, SP II:1; A406 Plot 2A, SP II:1; A301 Plot 3B, SP II:2) while other contexts are almost void (Plot 2A, SP II:2; A303 Plot 3B, SP II:1). On Plot 3A, the vessel-fragments are more evenly distributed in SP II:1 and II:2, while there seems to be a distinctly different activity pattern on Plot 2B compared with the other plots (note 8; Pilø 2007d:211). The relatively low total of vessel-fragments from Plot 4B is

Figure 9.40 *The presence of waste and raw materials from beadmaking, vessel sherds, and miscellaneous glass objects (windows, inlays and linen-smoothers) on the different (partly) excavated plots (SP I–III) of the MRE. Jørgen Sparre.*



due to limited excavation of this area. There is actually a relatively high frequency of vessel glass in the deposits uncovered (Fig. 9.32). The proportion of glassworking waste to vessel-fragments is particularly low on this plot and in the areas north and east of this. This is an area where little beadworking can have taken place.

It is tempting to attribute the observed variation to differences between the inhabitants of the plots in terms of social standing and the kind of tableware they used, or simply to activity zones in the settlement area (further below, 9.4.2 and 9.5).

9.2.7 The ploughsoils

A significant proportion of the original Viking-period deposits have been disturbed by ploughing (Pilø and Skre, this vol. Ch. 2:26). Stratigraphically and chronologically, it is necessary to distinguish between two plough-layers; the modern ploughsoil and a later medieval plough-layer that is only preserved on parts of the site. It is clear that the glass from these contexts forms two distinct assemblages (cf. Tab. 9.2) in respect of both the inclusion of modern material and the extent of horizontal dispersal (below).

On the whole, the Viking-period vessel glass from the late-medieval plough-layer and the modern ploughsoil is not significantly different from the stratified assemblage. Generally, the same vessel-types and decorative elements can be identified. A number of beach-rolled or heat-exposed fragments are recorded, but neither of these attributes have a higher frequency in the ploughsoil assemblages than in the stratified material when the size of the assemblages is taken into account. Nor is there any real increase of visibly decayed glass in the modern ploughsoil. Where decay is visible, the glass surfaces are slightly matted or pitted, or the cross-section displays well-advanced layering. There are no records of substantial corrosion crusts as visible on some Viking-period glass from, for example, Hedeby, Paderborn and Birka (e.g. Arbman 1940–3:pls. 191.2 and 193.2–3; Steppuhn 1998:pls.15–18; Stiegemann and Wemhoff 1999:catalogue nos. III.63 and 67–8). One would have expected increased decay to reflect the shift towards a potassium-rich glass documented in Europe during the 9th and 10th centuries (Henderson 1992; Dungworth et al. 2007). The EPMA and EDX analyses from Kaupang (Appendix 9.1), however, have confirmed that there is no simple correlation between visible decay and composition here. A similar observation was made at Borg (Henderson and Holand 1992:52–3). It is probable that calcium and/or lead that have been added to the potassium-rich glass have stabilised the material sufficiently to prevent extensive decay, and that humidity and salt levels in the deposits are more decisive factors.

The later medieval plough-layer

In the western part of the MRE excavation area and adjacent areas of the CRM pipeline-trench a *later medieval plough-layer* covers the 9th-century strata (Pilø et al. 2003:134–6; Pilø 2007a; Pedersen and Pilø 2007:186). It is assumed that nearly all finds from this stratigraphical level reflect Viking-period activity, and no post-Viking vessel glass has been positively identified.

Because the finds are redeposited their distribution will not be discussed in detail. However, spatial analyses of sherd-links and the distribution of fragments associated with specific Sherd Families indicate that horizontal displacement in this deposit is not extensive compared with that of modern ploughing. Admittedly, the evidence from which these conclusions are drawn is limited, and it is not possible to distinguish between depositional and post-depositional processes unequivocally. The conclusion is nevertheless corroborated by the distribution of fragments from a small number of very

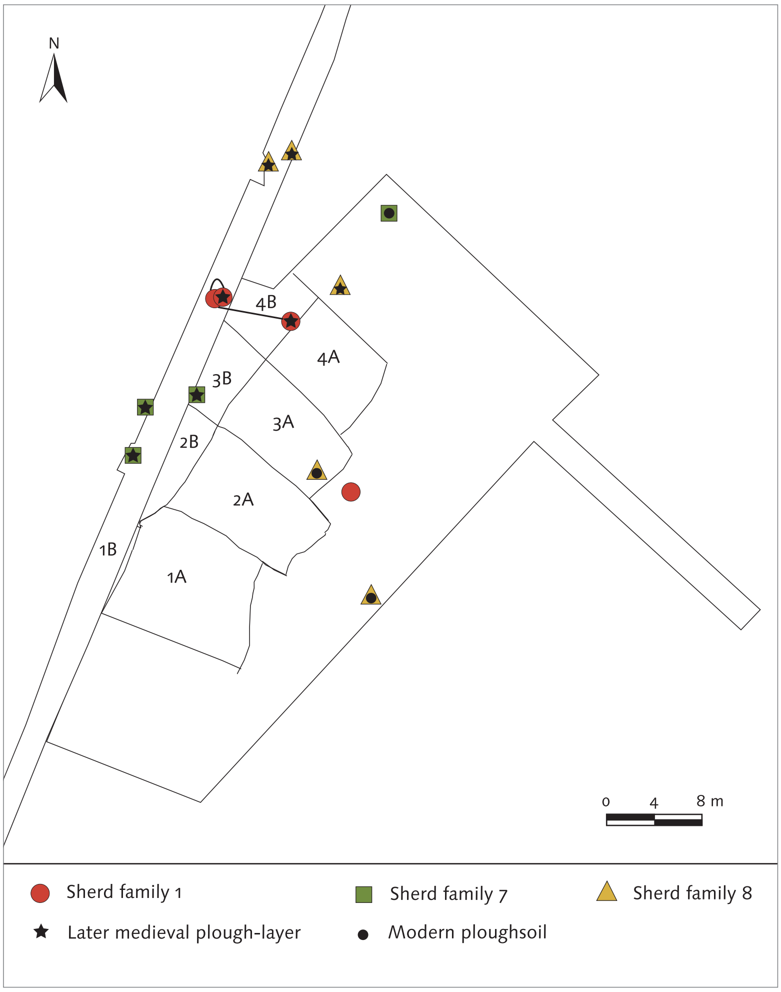


Figure 9.41 *The impact of medieval and modern ploughing indicated by fragments belonging to SF 1, 7 and 8. While fragments from the modern ploughsoil are frequently located several tens of metres away from pieces still in stratified deposits, finds from the later medieval plough-layer appear to have been subject to smaller shifts. Map, Elise Naumann.*

Figure 9.42 *Glass (excluding beads) collected from the surface during fieldwalking and metal-detecting at Kaupang, 1998–2002. Contour interval 1 m. Map, Elise Naumann.*

distinct vessels whose sherds have been collected both from the later medieval plough-layer and modern ploughsoil and from stratified layers (Fig. 9.41).

Two very large sherds from a jar with white reticella decoration (SF 1) were recovered in close proximity, in layers close to the trench dividing Plots 3B and 4B. They were probably discarded here immediately after the vessel was broken. A third, linked sherd was located in the later medieval plough-layer, 6.5 m south-east of the stratified pieces. The direction of displacement corresponds to the direction of medieval ploughing as documented on the neighbouring Plot 3B (Pilø et al. 2003:135).

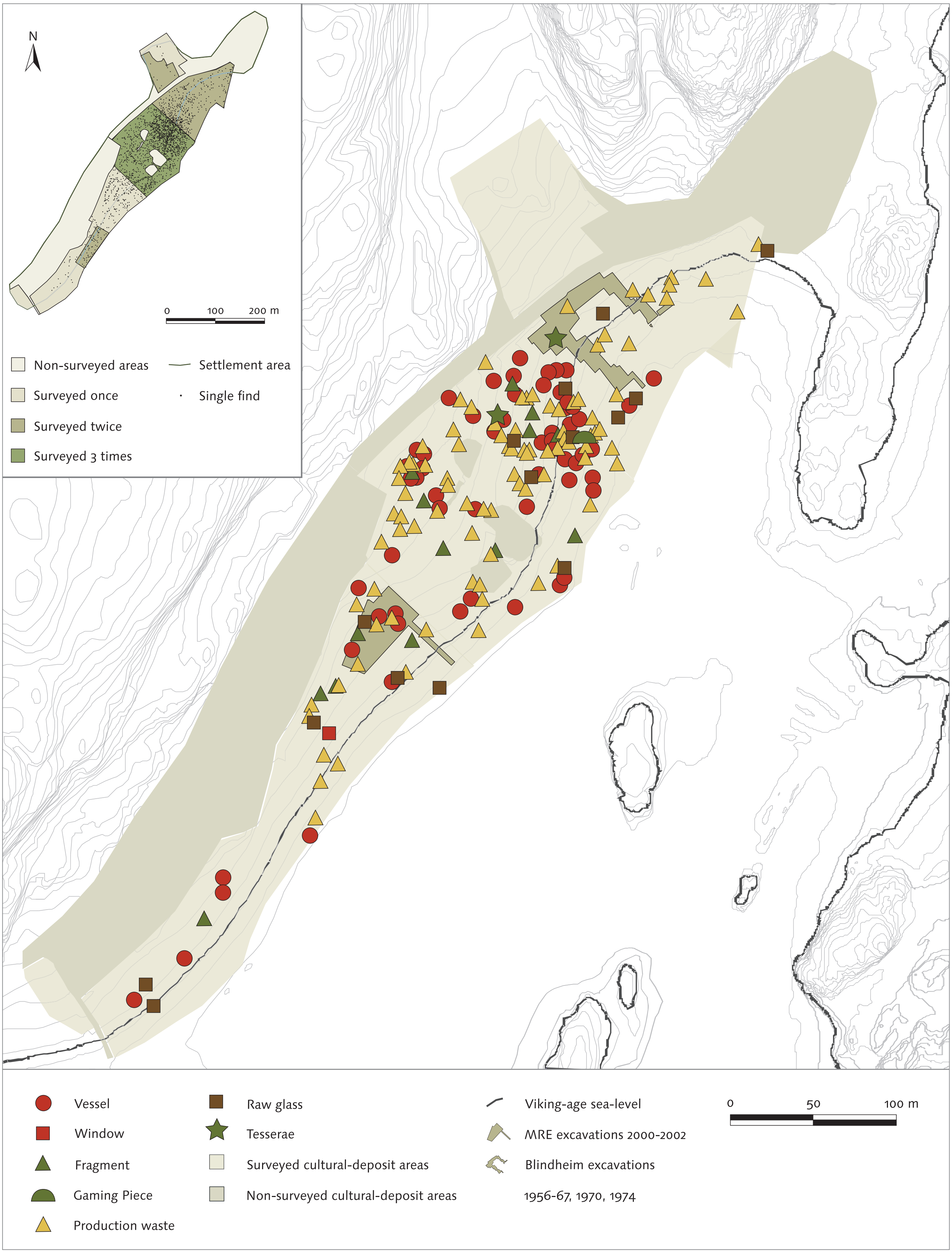
Fragments from two other vessels, a yellow jar with marvered white decoration (SF 7) and a green jar with horizontal pale yellow trailing around the rim and neck (SF 8), also provide valuable information. In both cases, it is possible to observe a significantly larger dispersal of the fragments found in the modern ploughsoil compared with the fragments from the later medieval plough-layer. With regard to SF 7, the distance between the most distant fragments is more than 35 m. The three sherds from the later medieval plough-layer are however clustered within a 5-m radius. The sherds' movement in the modern ploughsoil appears to correspond to the gently sloping topography. The direction of ploughing here is not recorded. A similar observation can also be made with regard to SF 3 and 10 (not illustrated).

While the bright sherds discussed above are probably all from small jars, the majority of identifiable sherds in the later medieval plough-layer are from funnel beakers – some with S-shaped rims or *in calmo* applications. Only in a limited number of cases has it been possible link these fragments with stratified Sherd Families (e.g. SF 12, Fig. 9.37).

The modern ploughsoil

The finds from the modern ploughsoil are scattered over the surface of the site and mixed with modern debris. Efforts have been made to map and record some of this material in the hope of gaining an impression of any chronological or activity-related differences across the site, as well as an insight into later settlement periods (9.1.2). The field surveys have provided a large collection of small finds. Nearly 200 artefacts, not counting beads, are of glass (Fig. 9.42). Although there are apparent concentrations of surface finds, these are considered to reflect areas where cultural deposits have been exposed and ploughed up, and cannot be used to identify different zones of activity within the settlement (Pilø 2007b:145). Vertical and horizontal displacements caused by deep ploughing and the sloping terrain also blur any meaningful distribution pattern. The result of the soil movement is most evident in the large number of artefacts now found below the Viking-period shoreline (3.5–3.7 m above present-day sea-level) east of the plateau in the central settlement area.

The identifiable sherds from the modern ploughsoil reflect the mixed character of the assemblage. A rim sherd from a reticella bowl like that found in Valsgärde grave 6 (C52519/10288) is chronologically a


N
0
100
200 m
Non-surveyed areas
Settlement area
Surveyed once
Single find
Surveyed twice
Surveyed 3 times
Vessel
Window
Fragment
Gaming Piece
Production waste
Raw glass
Tesserae
Surveyed cultural-deposit areas
Non-surveyed cultural-deposit areas
Viking-age sea-level
MRE excavations 2000-2002
Blindheim excavations
1956-67, 1970, 1974
0
50
100 m

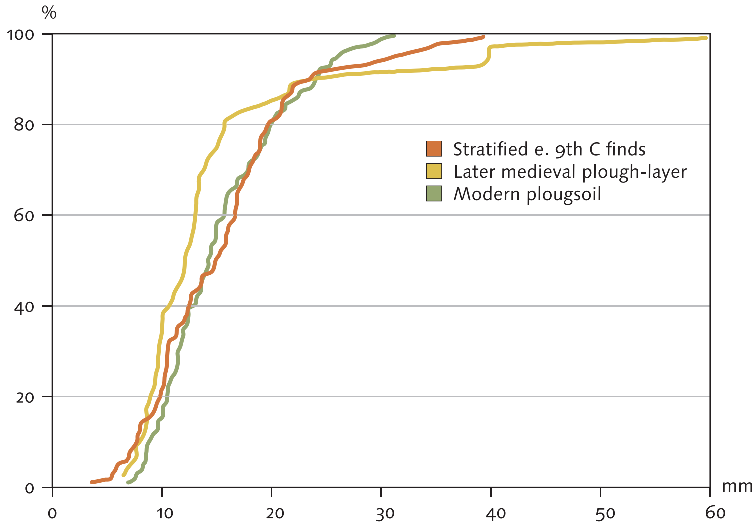


Figure 9.43 *Cumulative frequency diagram illustrating the size of vessels sherds in the modern ploughsoil assemblage (N=106), the later medieval plough-layer (N=47) and the stratified early 9th-century finds (N=103). Samples only include material from excavated and sieved CRM and MRE deposits.*

very early vessel-form (9.2.3) and is likely to come from early settlement deposits that have been ploughed up. The fragment of a grape beaker (C52519/38381) is also likely to be relatively early. A dark green *in calmo* rim from a small jar (C52264/723) is, on the other hand, likely to be of the late 9th or 10th century (9.2.3). Several deep blue sherds have also been collected from the ploughsoil. These are made of high quality glass with high gloss and clarity and few bubbles in the matrix, and could easily be considered modern were it not for their applied white trails (C52003/159 and C52264/588) or S-shaped folded rims (C52517/2421, C52519/29003 and C52264/803) which suggest an Early-medieval date. Amongst other potential late Viking-period vessel-fragments are two light green-yellow unfolded rim sherds from a cylindrical beaker or a jar decorated with thick vertical ribs (C52519/12250 and /41092).

It is difficult to make an accurate estimate of the number of vessels extant in the ploughsoil assemblage. While some of the finds from the ploughsoil covering the MRE trenches are likely to represent "new" Sherd Families (e.g. SF 19), a small number of sherds can positively be related or linked to vessels of which other fragments were embedded in the medieval or Viking-period strata (e.g. SF 3, 7 and 8).

The modern ploughsoil assemblage also includes a significant component of post-Viking-period glass (9.1.2) introduced through farming activity and waste disposal in the late-medieval or early modern periods.[12] Although attempts have been made to deselect both late-medieval and modern glass from the ploughsoil assemblage by eye, a small proportion of undiagnostic sherds may still represent such material. This material, of *uncertain date,* consists mainly of undecorated green or brown sherds which are slightly thicker than the stratified Viking-period material.

The ploughsoil assemblages and the character of the late 9th- and 10th-century occupation

Although the MRE excavation at Kaupang has provided much new information about the settlement during the first half of the 9th century the character of later occupation and the circulation of glass in that period are less clear.

It is not possible to approach the question of later vessel circulation through a direct comparison of the finds from the stratified layers and those from the later medieval plough-layer and modern ploughsoil. The assemblages are very different in respect of the method of artefact recovery, size, chronological span, and the extent to which younger and older material is mixed in the modern ploughsoil. The likelihood of finding "uncontaminated" late settlement material is highest in the later medieval plough-layer. In light of the limited movement of artefacts in this horizon (above), and the fact that vessel glass, if moved, is more likely to have been transported towards the beach because of the local topography, finds from the late-medieval plough-layer covering the north-eastern parts of the MRE deposits should mainly contain finds from deposits later than the underlying SP II:2 strata. The presence of six dirhams (the latest of the identified coins minted 859/60: C52519/14202, Rispling et al. 2008:no.63) confirms that these deposits include material from the latter half of the 9th or the early 10th century.

Whether the deposits also include glass from this period is difficult to determine with confidence. It has been suggested elsewhere (Blackburn 2008:70; Pilø this vol. Ch. 10:302–3) that Carolingian imports disappeared after the second or third quarter of the 9th century. Finds from graves in Birka and in western Scandinavia nevertheless indicate

12 Eight sherds (not published here) are positively identified as being from 13th- to 17th-century vessel-types.

that the importation of glass was maintained into the 10th century (Arbman 1937:67–8; Hougen 1968). The exclusive presence of some vessel-types (e.g. SF 7, 8, 14 and 19) in the later medieval plough-layer or modern ploughsoil at Kaupang suggests that glass vessels also continued to circulate here in the later part of the 9th and/or early 10th centuries. It is, however, difficult to be specific about how late these vessel-types should be dated. Although some sherds from the modern ploughsoil could, *per se*, be dated as late as the 10th or even the early 11th century (e.g. C52264/723, C52003/159, C52264/588, and C52519/12250 and /41092), the typo-chronological framework is not sufficiently precise to prove vessel circulation at Kaupang at this time (9.2.1).

One way of forming an impression of settlement density in different periods is to compare vessel-fragmentation in different sub-assemblages (Fig. 9.43). A densely built settlement would in theory expose the sherds to increased trampling and redeposition and so reduce sherd-size (Campbell 1991; cf. 9.2.4). The stratified early 9th-century assemblage was compared with the finds from the medieval and modern deposits to see if they are significantly different. Because material recovered during fieldwalking is likely to be biased towards large sherds easily spotted by surveyors, the comparison involves only excavated (sieved) material.

It is worth noticing the high proportion of relatively large fragments (25–60 mm) in the assemblage from the later medieval plough-layer. This indicates that the medieval ploughing did not automatically lead to further fragmentation of vessel sherds in the deposits, and that trampling is the most important factor in determining the extent of fragmentation. At the same time it cannot be inferred that the occupation associated with the late-medieval plough-layer assemblage was less intensive. The proportion of sherds more than 25 mm long makes up only about 10% of the total finds. The remaining 90% is actually more fragmentary than the comparable material from the stratified early 9th-century settlement deposits. This implies that the post-850 activity at Kaupang was as intensive as, or even more intensive than that of the early 9th century, despite the absence of preserved building structures from this period – a conclusion that is also corroborated by deposits investigated in the harbour basin in 2003 (Pilø 2007d:200–3). The sherd-size curve for the modern ploughsoil assemblage corresponds roughly to that of the stratified Viking-period material.

9.3 Window glass and miscellanea

9.3.1 Window glass

Nineteen fragments from Skre's investigations have been classified as window glass or probable window glass (Tab. 9.16). However, only five of these are from undisturbed Viking-period deposits or show attributes typical of Early-medieval window glass (e.g. Cramp 2000:108–12; Dell'Acqua 2001:173–5; Goll 2005; Wolf et al. 2005:373–5). Many of the sherds are coloured in the same shades of slightly matted green as later medieval and Early-modern window panes. This makes it difficult to determine whether fragments that are not from stratified contexts derive from Viking-period or later activity. Chemical analysis has nevertheless confirmed that two of the Kaupang fragments, C52519/19988 (KAU 49) and C52519/11358 (KAU 103), correspond to known Carolingian soda-lime-silica and potassium-rich glass compositions and are likely to be of the 9th or 10th century (Appendix 9.1).

Most Early-medieval window glass appears to have been manufactured using the *cylinder* technique or by *casting*. The cylinder technique involves blowing an elongated cylinder of glass. This is then cut open and flattened on a smooth surface: presumably a large marble block, iron pan or wooden board (Harden 1961:41–3; Dell'Acqua 2001:173–4; *De diversis Artibus* II.6, II.9 and II.18). When *casting*, molten glass was poured directly on to a flat surface and annealed. It is unclear how widely this latter method was used in the Early Middle Ages (below). A third technique, *crown glassworking*, where a flat disc is created by spinning the gather at the end of the blow pipe, was relatively little used in the Early Middle Ages and is not documented at Kaupang (cf. Dell'Acqua 2001:174, no. 11, pl. 6.3).

After cooling, the glass sheets were split in smaller panes, and the exact shape of the individual pieces could be adjusted to the required size and shape through *grozing*. This forming of the edges with a hooked iron leaves a distinct retouched edge that can be observed on both window-fragments and smaller glass inlays (below). Cutting-wheels were only used by glazers of late-medieval and early modern times (Hayward 1972:99; cf. Davison 2003:65–6), although they were employed to cut and engrave gemstones in the Merovingian and Carolingian Periods (Arrhenius 1985; Kornbluth 1995).

The identification of the different working processes described above in archaeological finds is controversial, and there is no consensus over how to tell them apart. Many of the features listed by Harden (1961:42–7) as typical of cylinder glass – the alternate matt and glossy surface, the layered structure and the flame-rounded edges – were considered characteristic of cast glass by George Boon (1966). Most commentators, however, agree that parallel rows of bubbles are an indication of cylinder blowing and that very thick glass (3–4 mm) was most probably cast. Rosemary Cramp (2000:108) has noted that the opposing views largely follow disciplinary boundaries. While Early Medieval archaeologists have generally accepted Harden's work as the basis for

Inventory no.	Note	Context	Colour	Thickness
C52519/28382		SP II:1	Very light yellow-green	1.4–1.5 mm
C52519/19988	Analysis: KAU 49	SP II:1	Dark green	1.7–1.9 mm
C52519/25135		SP III	Light green-blue	1.3–1.4 mm
C52516/3714		SP I–III	Medium grey-blue	1.1–1.3 mm
C52516/4148	Probable window	SP I–III	Light blue-green	3.2–3.4 mm
C52519/11636	Uncertain date	Later med. plough-layer	Very light yellow-green	1.3 mm
C52519/12099		Later med. plough-layer	Medium blue-green	1.4–1.5 mm
C52519/10165	Probable window	Later med. plough-layer	Medium blue-green	2.9–3 mm
C52519/11358	Analysis: KAU 103	Later med. plough-layer	Light green	2–3.4 mm
C52516/1232	Probable window	Later med. plough-layer	Light green	3–3.6 mm
C52519/12191	Uncertain date	Modern ploughsoil	Very light grey-green	1.1–1.2 mm
C52519/10035	Uncertain date	Modern ploughsoil	Light yellow-green	1.2–1.3 mm
C52519/40725	Uncertain date	Modern ploughsoil	Very light grey-green	1.3 mm
C52519/40715		Modern ploughsoil	Light blue-green	1.3–1.4 mm
C52519/38366		Modern ploughsoil	Very light grey-green	1.6–2.5 mm
C52517/2751		Modern ploughsoil	Very light yellow-green	1.8 mm
C52519/9871	Uncertain date	Modern ploughsoil	Very light yellow-green	1.8–1.9 mm
C52519/9976	Probable window	Modern ploughsoil	Medium blue-green	2.7–2.9 mm
C52519/10934		Modern ploughsoil	Medium yellow-brown	2.1–2.5 mm

Table 9.16 *Window glass and possible window-fragments from Kaupang.*

identification and so concluded that most, if not all, Early-medieval window glass was cylinder-blown, the majority of archaeologists working with Roman material have followed Boon. A new study of the window glass from the Carolingian church in Sion (Valais, Switzerland) has, however, suggested that much of this glass was cast (Wolf et al. 2005).

In these circumstances it is difficult to determine how the Kaupang windows were manufactured. The material is too sparse and fragmentary to warrant an independent study of the manufacturing process. It is nevertheless possible to distinguish two main groups of material: a group of thin, homogeneous fragments with high gloss and clarity, and a group of thicker, layered glass (Fig. 9.44). These are presented below:

C52519/19988 is dark green, with traces of grozing on two edges. C52519/12099 is lighter green and with no preserved retouch. Both fragments are relatively thin (1.3–1.9 mm) and have a number of small bubbles dispersed in the matrix. In C52519/12099 these are slightly elongated and in parallel rows. Both fragments display high gloss and clarity. One surface of C52519/12099 shows imprints of what might be grains of sand.

The remaining group of thin window-fragments (C52519/25135, /28382, /11636 and /40715, and C52516/3714) are all in light tints of green and blue, often with a slightly matted surface.

Many of the thicker fragments have the original edges of the panes still preserved (e.g. C52519/11358 and C52516/4148). When the cylinder is opened up to be flattened out, the furnace heat causes the edges to be rounded and, sometimes, slightly thickened in a way very similar to what is seen on vessel glass with unfolded rims (Dell'Acqua 2001:174). Boon (1966) has suggested that the edges of cast window panes would also be rounded where the molten glass did not reach the perimeter of the mould. The similarities to the thickened rims of vessel glass can make it difficult to differentiate between small edge-fragments of window panes and of vessels, especially as window glass is not always completely plane (cf. C52516/1232 and /4148, and C52519/9976 and /10165). The contact between the glass and the marver used to flatten the window also produces a characteristic difference between the verso and recto surface of the panes. The recto surface is very smooth to the touch, although there may (as with C52519/19988 and /12099) be imprints of sand or other material left on the block (Dell'Acqua 2001:174). The verso, on the other hand, is often rough, with a fine pattern of ripples and parallel structure-lines probably caused by the swift cooling of the surface relative to the interior of the glass. The combination of rough and smooth surfaces is found on most of the Kaupang glass of both groups, and is the best way to identify small fragments of window glass without edges. The rippling, however, is only found on the thicker fragments.

Figure 9.44 *Examples of thin and thick window glass from Kaupang. **a:** C52519/19988. **b:** C52519/11358. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

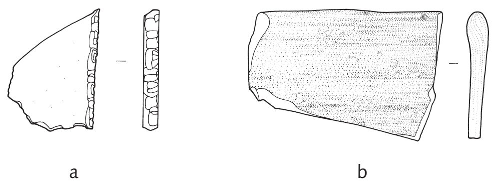
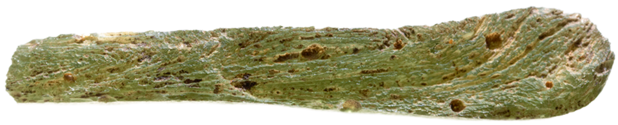


Figure 9.45 *Magnified cross-section of C52519/11358, clearly showing the layering of the glass (Scale 4:1). Photo, Eirik Irgens Johnsen, KHM.*



Another typical feature of the thicker window-fragments is that the glass has a layered structure in cross-section (Fig. 9.45). The end of these layers often seems to cause the rippling described above, almost as if the upper glass layers have contracted and failed to cover the surface completely (e.g. C52519/11358 and C52516/1232). Dell'Acqua (2001:174, following Harden 1961:46) maintains that the layering must have been caused by continuous dipping of the gob to gather enough glass on the paraison to produce the required sized sheet, and that the surface ripples are due to the rapid cooling of the glass surface. The thickness of the Kaupang glass indicates, however, that these pieces should be attributed to the casting method. Peter Cosyns (2004:50, fig. 46), elaborating on Boon's (1966) thesis, suggests that the layering is best explained by the thermo-dynamic effects of casting. When the glass is spread, each superimposed layer is allowed to form a thin cooling surface prior to the next application of glass. Wolf et al. (2005:374–5) have suggested that the surface rippling could be a product of either the flow of the glass or the spreading of the glass with a rake.

Early-medieval window glass is associated predominantly with churches or ostentatious secular palaces where no expense was spared. On the Continent, such buildings were increasingly constructed in stone during the 8th and 9th centuries, and it seems plausible that glazing was intimately associated with this building development. Only a small number of window-fragments so far have been reported from Early-medieval market towns and settlements with timber buildings (cf. Hunter and Heyworth 1998:20–6). A substantial number of window-fragments (233), however, were brought to light during the 1990–1995 excavations at Birka (Björn Ambrosiani, e-mail 23.11.2006). Most of the glass was found in Phase 7 and later layers (i.e. of the 10th century), and many of the sherds were concentrated outside the gable of one wooden building. This suggests that they might derive from a window set into the wall, and that houses in coastal market towns could feature such architectural details, during the late Viking Age at least.

The number of window-fragments from Kaupang is small, however,[13] and it is difficult to say whether the majority of material should be associated with Viking-period or later activity. There are no obvious concentrations of finds, and no traces of lead cames or other materials used to fix the panes to window openings have been recorded in the MRE area (frames of wood, however, are unlikely to have survived). The fact that five out of eleven window-fragments from stratified Viking-period deposits or the later medieval plough-layer are edges should also be noted. These may represent primary wasters from the manufacture of window panes rather than finished windows. Therefore, in my view, it is unlikely that the window glass was used in the buildings that have been excavated on the site. Whether glazing might have been a feature of buildings in other parts of the settlement or in later phases (as has been suggested for Birka) one cannot tell, but the most likely explanation of the presence of window-glass fragments at Kaupang seems to be their use as inlays, or perhaps as raw material for beadmaking (below, 9.4.3; see also Hougen 1969a).

9.3.2 Miscellanea

Inlays

Several glass finds from Kaupang are best understood as decorative inlays from portable objects or jewellery. All the objects are purposefully shaped and generally smaller and thinner than fragments

13 Sixteen fragments uncovered during Blindheim's settlement excavations have been classified as window glass by Hougen (1969a).

interpreted as parts of composite windows. The shape and matrix characteristics of the inlays are otherwise quite varied, and give the impression of an *ad hoc* use of materials. In one case (C52519/27578) it has been difficult to determine whether the glass is actually a window element or was destined for a smaller portable object, while another fragment (C52519/18698) appears to be a reshaped vessel-fragment.

A false cabochon with geometrical decoration has been retrieved from the modern ploughsoil covering the MRE area (C52519/10545, Fig. 9.46.a). The cabochon is double-convex (maximum thickness 2.6 mm) and cast from pale, translucent green glass. It must originally have been circular, with a diameter of c. 9 mm. Both the edge and the convex reverse were shaped by grinding, and the reverse shows fine lines from honing with a fine abrasive. Shallow grooves in the surface are filled with white opaque glass. The design consists of a stepped cruciform pattern, bound by a circle close to the edge. A clay mould from Lagore Crannog (Co. Meath, Ireland) with a glass stud still attached at the bottom illustrates the manufacturing process (Hencken 1953:128–32, fig. 62.1302; Haseloff 1990:no. 127. See also Spall 2003 for a similar mould from Tarbat, Ross-shire, Scotland). The cast grooves could be in-filled with glass or metal, before the shape of the cabochon was finished by grinding and the surface polished (Haseloff 1990:163–4). From Scandinavia, similar designs are known from metal mounts with inlaid champlevé enamel (e.g. Tårstad and Kaupang: Haseloff 1990:nos. 157 and 159). A very similar, but larger, blue glass stud has been recovered in Hedeby (Steppuhn 1998:pl. 25.22). Other glass studs are decorated with pelta-shaped or semi-circular lines (see, for example, the inlays on the Helgö crozier and the Skjervum mount (Haseloff 1990:nos. 146 and 160). It is impossible to know if the Kaupang cabochon arrived at the site as part of a larger metal object or on its own.

The stepped design is often associated with 7th-/8th-century Celtic workshop traditions (e.g. Wamers 1985:32; Haseloff 1990:165–9), but Evison (1991:145 and 147, with refs.) has drawn attention to several contemporary Anglo-Saxon finds (e.g. Webster and Backhouse 1991:fig. 108e). While the Kaupang cabochon is certainly Insular, it is impossible to determine its provenance more closely. Many British and Irish finds are associated with ecclesiastical or monastic sites, and several sacral vessels, reliquaries and crosses were decorated with glass inlays. A blue glass stud with a similar stepped design occurs, for example, on the Derrynaflan paten (Haseloff 1990:no. 130). The often-repeated idea (e.g. Capelle 1968:78, with refs.) that high-quality products of this kind should exclusively be associated with monastic workshops can no longer be maintained. Glass cabochons are also known from pendants in Anglo-Saxon graves: for example Kingston Down, Kent, grave 172 (Evison 2000:84 with refs) and Everthorpe, Yorkshire E.R. (personal observation, *Hull and East Riding Museum*, Accession no. KINCM:1958.83.1), and circular cabochons with a stepped pattern, as the Kaupang piece, were applied as decorative studs on a range of brooches, buckles and even on chains linking Anglo-Saxon linked pins (Haseloff 1990:nos. 133–7). The workshop evidence from Lagore Crannog also represents a high-status secular context.

C52519/20461 and C52519/7070 (Fig. 9.46.b–c) are very different kinds of inlays. The former is a geometrically shaped fragment, only 4.5 mm across, with plane surfaces (0.5 mm thick). It is cut from a larger quarry, with all the edges finely grozed. The shape is nearly trapezoid, but with two slightly curved parallel edges forming a "circular segment" where the centre is cut away. The matrix is bright yellow-brown and almost without bubbles. C52519/7070 is also cut from a larger quarry, but the shape is nearly circular (1.1 mm thick with a diameter of 7.3–7.7 mm) and the retouch slightly rougher. There are some bubbles dispersed in the emerald green matrix.

Both objects were probably intended to fill cloisonné cells on portable metalwork or pieces of jewellery, a technique that was common in both Continental and Insular workshop traditions. The pieces may have reached Kaupang as components of metalwork that was broken up and remelted. Both inlays are from the later medieval plough-layer covering Plots 3B and 2A. Traces of metalworking have been recorded in the near vicinity, on Plot 1B (Pedersen, in prep.) and in the area north-east of Plot 3B (Wiker 2001:17–9; cf. Pilø et al. 2003:124), but it is not possible to relate the glass directly to these finds. Although the shapes could have been imported to Kaupang as raw materials for local jewellery production and cut there, glass inlays are not common in Scandinavian craft products of the 9th and 10th centuries (Arrhenius 1971). It is more likely that the inlays were intended to decorate weights manufactured at Kaupang (Pedersen 2008:170–3). Several weights with inlaid glass, amber or metal mounts are known from Anglo-Scandinavian and Scandinavian areas, and a flattened lead weight with a small glass inlay was also recovered from the ploughsoil at Kaupang (C52519/15228; Pedersen 2008: fig. 6.36). Another possibility is that the glass cells are from pieces of jewellery worn by inhabitants or visitors to the site.

The identification of C52519/26130 and C52519/18698 as inlays is less certain. The retouch or the former is very irregular and the resulting shape is not strictly geometrical. C52519/18698 forms a circular segment with retouch along the curved edge.

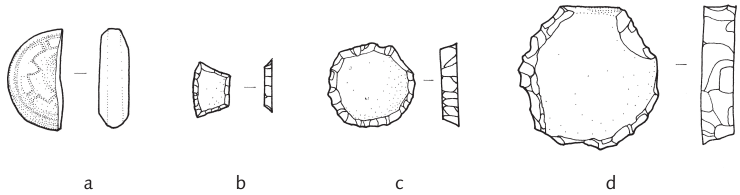


Figure 9.46 *Inlays of glass from Kaupang.*
***a:** C52519/10545. **b:** C52519/20461. **c:** C52519/7070.*
***d:** C52519/27578. (Scale 1:1).*
Drawing, Bjørn-Håkon Eketuft Rygh.

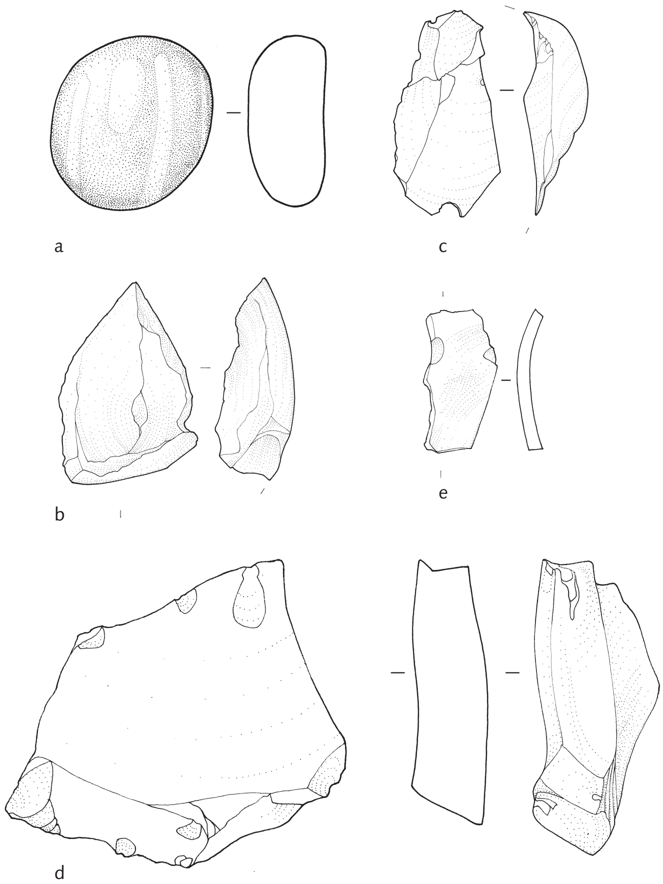


Figure 9.47 *6 A gaming piece and fragments of glass linen-smoothers from Kaupang.*
***a:** C52516/1770. **b:** C52519/10388. **c:** C52519/27397.*
***d:** C52519/40723. **e:** C52519/2837. (Scale 1:1).*
Drawing, Bjørn-Håkon Eketuft Rygh.

This indicates deliberate shaping, as with the other inlays, but the fragment is slightly convex and was probably originally part of a glass vessel. The context of the find, a layer with much metalworking refuse between Plots 1A and 1B (AL68371), may indicate that the sherd had been re-used as an inlay after the vessel was broken, like domed fragments from York (Hunter and Jackson 1993:1343, fig. 649, no. 4760) and Helgö (Lundström 1981:4).

C52519/27578 (Fig. 9.46.d) is significantly thicker (2.7–3.1 mm). It is a nearly circular disc of light blue-green translucent glass (diameter 12.2–13.7 mm) with coarse two-sided retouch. The surface is slightly matted and scratched and the glass slightly layered. Although the piece may well be an inlay originally set in a portable object, similarly shaped and sized window quarries are also known from late Merovingian and Carolingian sites (e.g. Paderborn: Stiegemann and Wemhoff 1999:no. III.66; St. Martin, Tours: Motteau 2005:fig. 108, top left). Plastered window screens, with small circular or other geometrical quarries of glass were, moreover, common in early Islamic architecture (e.g. 8th-century Khirbet Al-Mafjar, Jordan: Brosh 1990).

A gaming piece[14]

C52516/1770 is an oval gaming piece of dark translucent blue glass decorated with several horizontal lines of marvered, opaque white glass (Fig. 9.47.a). The reverse is roughly flattened, with several shallow grooves criss-crossing the surface. The shape (16 x 13.8 mm; max. thickness 7.3 mm) has no close parallels in grave finds from the Late Scandinavian Iron Age (Kristensen 2007) but resembles pieces in sets dated to the Roman Iron Age. Other gaming pieces of near identical shape, but without decoration, have come to light in the settlement areas of Hedeby (Steppuhn 1998:78, pl. 25.21) and Helgö (Holmqvist et al. 1970:81, no. 8254, pl. 22.39). This could point to the re-use of Roman gaming pieces or the recycling of the glass in the Viking Period. Kristina Danielsson (1973:59, fig. 32e) has, however, noted that a glass gaming piece from the harbour area of Birka is much smaller than contemporary examples from graves on the site. The bone gaming pieces from Kaupang are also smaller than comparanda in Scandinavian grave finds. It is possible, therefore, that the smaller gaming pieces of glass and bone represent a type not present in high-status graves like the Birka chamber graves (Arbman 1937:63–6, pl. 15, 1940–3:pls. 147–50; Lindquist 1984, with refs.).

14 C52264/4:1 was also originally collected and catalogued as a gaming piece. Closer inspection suggests that it is an early modern glass button.

Inventory no.	Site Period	Shape	Notes	Interpretation
C52516/110	Modern ploughsoil	No original surfaces		Raw glass?
C52517/1624	Modern ploughsoil	No original surfaces		Raw glass?
C52519/2837	Modern ploughsoil	Hollow	Parallel wear-marks	Linen-smoother?
C52519/9621	SP I–III	No original surfaces		Linen-smoother
C52519/9817	SP I–III, midden area	Convex	Crystalline inclusions	Linen-smoother
C52519/10388	Modern ploughsoil	Convex	Crystalline inclusions	Linen-smoother
C52519/27397	SP I–III	Convex		Linen-smoother
C52519/40723	Modern ploughsoil	Flat billet	Crystalline inclusions	Raw glass?

Table 9.17 *Likely or possible fragments of linen-smoothers from the settlement area at Kaupang.*

Linen-smoothers

Linen-smoothers are bun-shaped or flat glass objects or stones used to smooth textiles and sharpen garment folds on flat boards of whale bone or wood.[15] They have been recovered from Early-medieval settlements and graves in western Europe and Scandinavia, and in parts of Europe their use has been documented well into the early modern period (Haevernick and Haberey 1965; Steppuhn 1999). The recovered examples of glass are generally 70–100 mm across and 25–50 mm thick. The glass is often dark, and appears opaque.

No linen-smoothers have come to light during the cemetery excavations at Kaupang (Appendix 9.2), but Hougen (n.d.) has noted that some of the thick "opaque" glass fragments from Blindheim's settlement excavations could be pieces of linen-smoothers (e.g. A62/w, A62/dd and MO60/8f).

Some of the many irregular glass fragments from Skre's excavations are also likely to be pieces of linen-smoothers (Tab. 9.17). Most of the fragments are *compact* and relatively thick (8–13 mm). In three cases part of an original convex surface is preserved, while one fragment is billet-shaped, with two roughly parallel sides (Fig. 9.47.b–e). The shape indicates that they were parts of discoid or bun-shaped cakes of glass. Unfortunately, the pieces are too fragmentary to measure the original thickness or diameter. The glass is medium-to-dark brown-green, murky, and often has a number of beige/white crystalline inclusions in the matrix. It is occasionally slightly weathered with an irridescent surface, but none of the examples have thick and brittle corrosion crusts like several examples from Hedeby (Steppuhn 1998:pl. 17). Several other textile-working implements have also been uncovered in the settlement area at Kaupang (Øye, this vol. Ch. 13).

Although their morphological characteristics suggest that the glass fragments are pieces of linen-smoothers, a positive identification has only been possible through compositional analyses (Appendix 9.1, KAU 7–9, 114). Four samples were identified as lead-potassium-silica glass (Fig. 9.48) and the EPMA analyses further suggest that the sand source is different from the Levantine sand from which most Early-medieval glass was fused. This composition is typical of linen-smoothers uncovered in France (Gratuze et al. 2003a), and examples have also been identified in 9th- and 10th-century Hedeby (Dekówna 1990), in the British Isles (Bayley 2006), and in Novgorod (Ščapova 1992). It has been suggested (Gratuze et al. 2003b) that the lead-potassium-silica glass was made using a slag by-product of Carolingian silver mining in Melle (Dept. Deux-Sèvre). Isotope analyses of three fragments from Kaupang confirm that the lead is likely to come from the Melle ore (Guerrot 2007).

There has been some discussion in the past whether one should regard all spherical buns of glass as linen-smoothers or if they could also be cakes of raw glass intended to be broken up and remelted (see Steppuhn 1999 for a recent review). Charlestone (1963) demonstrated that round cakes of raw glass were widely distributed in early modern times, and he suggested that this trade went back much further than the written records. On the site of Åhus I in Skåne (c. AD 700–750) micro-debitage has shown that some of the blue raw glass splinters used for bead-making came from bun-shaped cakes of glass (Callmer and Henderson 1991:144, fig. 2). Raw glass bars have also been found at Groß Strömkendorf (Pöche 2005:pl. 10.19–20), Ribe (Jensen 1991:37, bottom picture) and at Frol (Nord-Trøndelag), where a bun-shaped "linen-smoother" of blue glass was recovered from a cairn in the early 20th century (T13696).

Charlestone's study (1963) indicated that individually shaped ingots primarily were of special qualities of glass (Venetian black or opaque white, red or yellow glasses, pure cobalt coloured blue glass, etc.), either coloured in a way that was beyond the

15 These objects have nevertheless only been found together in grave 854 at Birka (Arwidsson 1984a).

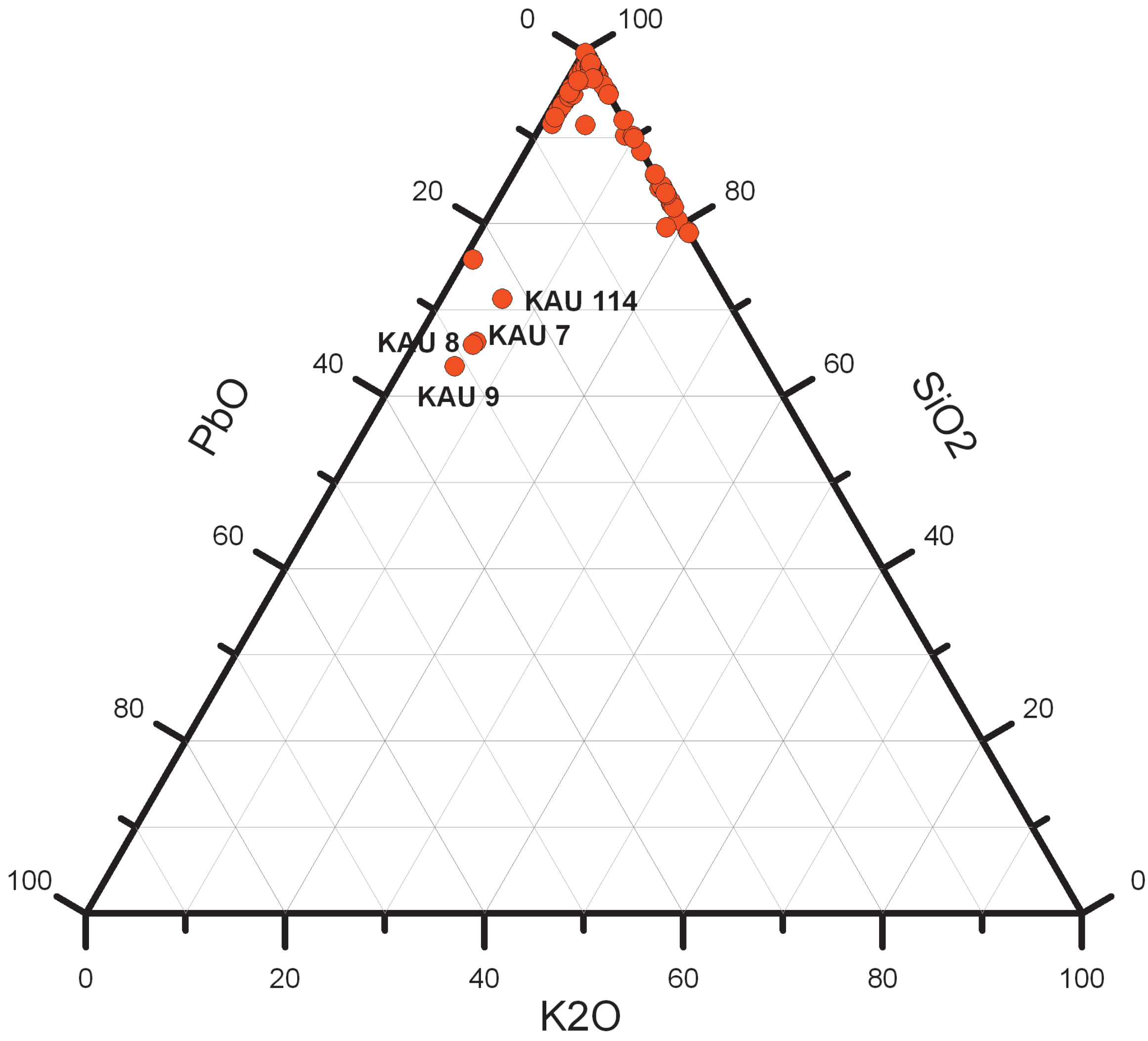


Figure 9.48 *Ternary diagram illustrating the relative content of lead, silica and potassium oxides in glass from Kaupang. The plot shows clearly the isolated group of lead-potassium-silica glass (KAU 7–9 and 114). Adjacent is KAU 28 – a soda-lime silica glass opacified with lead stannate.*

know-how of local glass manufactories or from raw materials that were unavailable to them. Most Early-medieval raw glass was, however, apparently exported in the form of irregular chunks (Foy et al. 2000; Foy and Nenna 2001, esp. 37–41). The Serçe Limani shipwreck, for example, contained two tonnes of irregular raw glass (in addition to one tonne of sherd material) when it sank off the coast of Asia Minor in the 1020s (Bass 1984; Parker 1992:no. 1070; van Doorninck jr. 2002:902–3; Bass et al. 2004:268).

Significantly, lead-potassium-silica glass of the kind that characterises many linen-smoothers, including the analysed linen-smoother fragments from Kaupang, has not yet been identified in any other objects (Gratuze et al. 2003b:105–6). This strongly implies that the dark green glass buns were exclusively utilitarian objects, made of a cheap and easily available by-product of the mining industry and not a source of raw glass. Apart from the green linen smothers, only one blue raw glass fragment from Kaupang (C52264/5 [1013]) has an original convex surface preserved, indicating that it may be part of a specialised ingot (below, 9.4.1).

A small number of *hollow,* inflated linen-smoothers are also known from Hedeby, Hopperstad in western Norway (B4511), and Birka grave 854 (Arbman 1940–3:pl. 153.4) as well as a number of Continental finds (Steppuhn 1998:75, pl. 18.9–13). Fragments may be identified from similar parallel wear-marks as seen on compact specimens (Steppuhn 1999:figs. 3–5; Evison 2000:84). Matthew Stiff has nevertheless warned against mistaking scratches occurring on vessel bases for smoothing marks (Stiff 1996:94–5). One fragment from Kaupang (C52519/2837), initially recorded as a vessel-fragment, may be a hollow linen-smoother (Fig. 9.47.e). The assemblage from Blindheim's settlement excavations contains other possible examples (A62/cc, BO66 and C64/3y: personal observation, KHM). The two latter finds have also tentatively been identified as linen-smoothers by Stiff (1996:295).

Inventory no.	M	Tr	D	S	R	(T)	RE	(T)	Raw	B	Total
C52003	3				11	7	2		1		17
C52167	2				1		1				4
C52263	1				3	1				1	5
C52264	6		1		27	13	2	1		2	38
C52265	1		1		1	1					3
C52516	5	3	16		61	39	13	2		4	102
C52517	1		1	1	18	12	2		3	2	28
C52519	62	5	50	6	206	130	36	5	3	15	383
C53160	1	1			3	2	4			2	11
Total	82	9	69	7	331	205	60	8	7	26	591

Table 9.18 *Numerical overview of the glass-bead production waste from Kaupang (1998–2003). Material from the MRE excavation, discussed in detail here, is highlighted. M = various melt lumps; Tr = trails; D = drops and droplets; S = melted sheets of thin glass; R = rods; (T) = proportion of rods (and rod ends) that are twisted; RE = rod ends; Raw = part-melted fragments of raw glass; B = failed beads.*

9.4 Traces of glassworking at Kaupang

Beadmakers were amongst the first artisans to establish themselves on the excavated plots at Kaupang, from the start of occupation in SP I (c. AD 800–805/10). Their workmanship and finished products are illuminated through the raw materials, waste and beads left behind on the site. This section of the chapter will present a quantified overview of this material, describe its most characteristic features, and discuss its spatial and stratigraphical distribution in the MRE area. The finds have been studied primarily to clarify any relationship with the vessel-glass assemblage and which raw materials the beadmakers used. A detailed account of manufacturing techniques and the relationship between imported and locally produced beads can be found elsewhere (Wiker, in prep.).

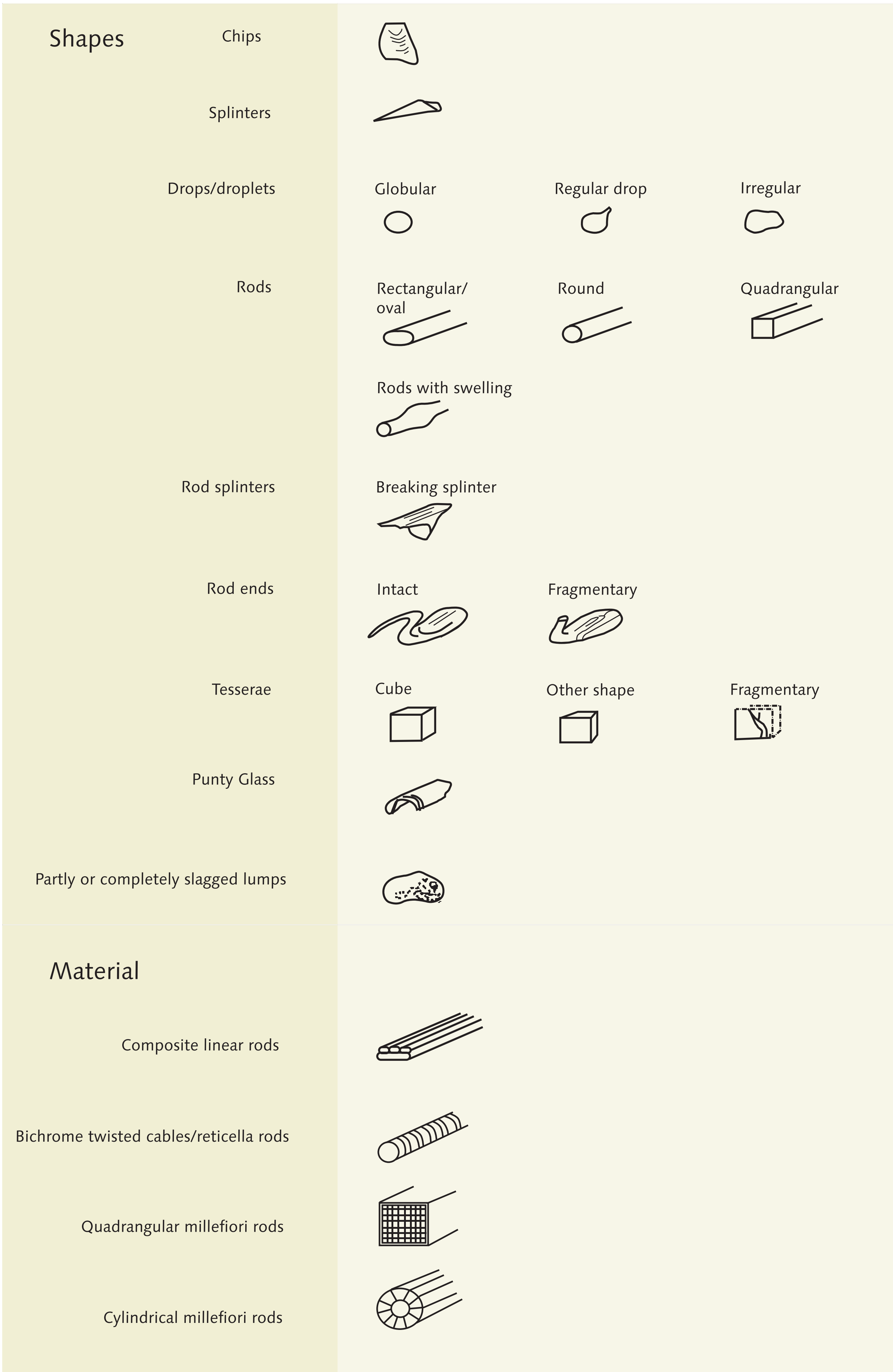
9.4.1 Material associated with beadmaking

Finds associated with glassworking form the largest individual component of the Kaupang glass assemblage except for beads, with 591 individual fragments. 220 are from phased contexts (SP I, II, III or I–III), 56 can be attributed to the Viking Period generally, while a further 86 and 229 finds were recovered from the later medieval plough-layer and the modern ploughsoil respectively (Tab. 9.2). These figures do not include the many other pieces of potential raw material: tesserae, raw glass, vessel glass, and other miscellaneous glass objects that will also be discussed in this section. The material shows beyond doubt that opaque white, translucent blue and pale green annular beads were manufactured at Kaupang (Wiker 2007). Some polychrome beads and beads made from bichrome twisted (reticella) cables may possibly also be linked with local production. It is, however, mainly the monochrome blue and white, and some of the yellow-green, material associated with the stratified MRE deposits which will be treated in detail here. Other material is covered in less detail (for these finds see Wiker, in prep.).

Most of the finds show signs of melting and/or mechanical manipulation. The objects can however be further sub-divided on morphological grounds and on the basis of their likely material of origin (Tab. 9.18). These categories include finished and failed beads, probable raw materials and semi-manufactures (raw glass, tesserae, rods), and waste (melt drops, trails, rod ends) (Fig. 9.49). There are also a number of amorphous melts and melted "sheets" of glass (likely to derive from window- or vessel-fragments) that *may* be related to glassworking. The fragments are generally very small in size, and mainly collected from the excavated (sieved) deposits (C52516 and C52519). The surface-collected assemblages are biased toward larger and diagnostic pieces (rods and rod ends <64 mm). Beads have been classified using Johan Callmer's terminology (Callmer 1977).

Diagnostic pieces are consistent with what one would expect from production of wound beads from rods drawn out with small tongs or tweezers. This is similar to the technique identified at Åhus I (Callmer 1990; Callmer and Henderson 1991), Ribe (Näsman 1979; Gam 1991; Sode 2004), Helgö (Lundström 1976, 1981) and Groß Strömkendorf (Pöche 2005). It has been suggested that a different technique, involving the direct dipping of a mandrel in molten glass, was employed in the later settlement

Figure 9.49 *Classification of beadworking waste. Illustration, Elise Naumann after Callmer and Henderson 1991:fig. 1.*


Shapes
Chips
Splinters
Drops/droplets
Globular
Regular drop
Irregular
Rods
Rectangular/ oval
Round
Quadrangular
Rods with swelling
Rod splinters
Breaking splinter
Rod ends
Intact
Fragmentary
Tesserae
Cube
Other shape
Fragmentary
Punty Glass
Partly or completely slagged lumps
Material
Composite linear rods
Bichrome twisted cables/reticella rods
Quadrangular millefiori rods
Cylindrical millefiori rods

period (Dungworth et al. 2007; Wiker, in prep.), but this cannot be demonstrated from the finds from the early 9th-century settlement deposits.

The spatial and stratigraphical relationship between the different forms of glassworking waste and other material potentially associated with beadmaking will be discussed in detail below. The absence of primary glass workshop contexts should, however, be noted at the outset. No furnaces or hearths can be associated with glassworking and no floor surfaces have been preserved *in situ* in the areas with the highest concentrations of waste (compare, for example, Bencard et al. 1990:figs. 53–9). This may indicate that the activity took place outdoors and/or that the plots were thoroughly cleared and levelled after production prior to new occupation. The quantity of equipment found is also very limited.

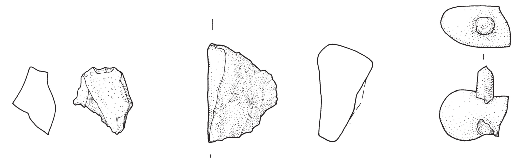
Glassworking equipment

Two very small fragments of fine grained, hard fired ceramic material with remains of glass *may* be parts of glass-melting crucibles, although this is *not* altogether clear (Fig. 9.50.a–b). C52519/41091 is a small fragment (9.1 x 8.4 x 7.1 mm) of heterogeneous, part opaque blue to blue-grey glass, fused to a slagged piece of crystalline material. It resembles the bottom of a crucible with glassy remains (alternatively it could be a part slagged and deformed tessera). C52519/2178 is a small wedge-shaped fragment (18.8 x 13.4 x 10.9 mm) of ceramic material with three concave sides, of which two are now (part-)covered with blobs of opaque red, translucent brown-green and brown-yellow glass.

The ceramic material resembles that of metalworking crucibles from Kaupang, but the small fragment-size makes it difficult to say anything about their shape. C52519/2178 may look like a crucible handle, but may in fact have been secondarily altered by heat. Even less of the vessel is preserved in the case of C52519/41091. Both fragments are from the ploughsoil assemblages. The use of metalworking crucibles for glass melting is untypical in the Early Middle Ages, when coarse-ware cylindrical or open cooking pots appear to have been preferred (Sablerolles et al. 1997:304–5). No discs or sherds of pottery with traces of glass (so-called trial pieces; cf. Biek and Bailey 1979:13) that are often found at glassworking sites have been recorded at Kaupang. This may suggest that any glass melting that took place in crucibles at Kaupang should be associated with metalworking or may be the result of accidental spillage. At present, no analyses have been carried out of the glassy remains.

The only definitive glassworking tool is a part of a beadmaker's mandrel of iron with a deformed grey-white bead still attached (Fig. 9.50.c). The mandrel fragment is only 8.8 mm long, and broken at both ends. The cross-section of one end is square

Figure 9.50 *Possible fragments of glass-melting crucibles from Kaupang (a-b) and parts of a beadmaker's mandrel with a failed bead (c). **a:** C52519/41091. **b:** C52519/2178. **c:** C52519/21706. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*



and slightly tapering (2.5–2.6 mm across). The other end is circular and appears to expand slightly where it is fractured. This size and form correspond well to fragments and complete mandrels from Paviken, Helgö and Ribe (Lundström 1981; Lindqvist 2003; Sode 2004:fig. 3).[16] The matrix of the bead is very impure, with dark inclusions of ?iron oxide. One surface is also partly covered in a fine, red-fired clay-like material. Similar red "clay" is found on a significant minority of the glassworking waste, and it is unclear if this represents accidental contamination from workshop surfaces, a material purposefully added to the glass, or a slip (such as kaolin) attached to the mandrel to facilitate the removal of the finished beads (Gam 1991:167–8; cf. Sode 2004:90).

Glass rods

In the absence of *in situ* workshop surfaces, the most conclusive evidence for local bead production at Kaupang comes in the form of rods and rod ends together with finished and failed annular beads in corresponding colours (Fig. 9.51, Tab. 9.19). 73.1% of the rods are blue or white (N=286), with a green constituent of 17.6% (N=69). 48.6% of the material is opaque (N=190). Wiker (2007:fig.3) has demonstrated a close correspondence between the proportions of rods and finished beads in translucent green, blue and opaque white glass. It is also possible to demonstrate that there is a close correspondence between the chemical composition of some of the opaque white and translucent blue rods and some finished beads (below, 9.4.3). This seems to confirm the excavators' assumption that the beads were indeed manufactured from the rod material recovered. There is, however, also a wide range of material other than rods which could be related to local bead

16 An iron "spit" recovered by Blindheim in the settlement area (MO706/59) could also be a beadmaker's mandrel (Blindheim et al. 1999:122, fig. 1).

Colour	Count	(T)	%	Polychr.	(T)	%
Black	2	1	50			
Blue	101	50	50	12	11	91.7
Blue-Green	22	12	60	4	4	100
Blue-White, Opaque	51	37	72.5			
Green	4	0	0			
Green-Blue	17	5	29.4	1	0	0
Grey-Green	9	3	33.3			
Grey-White, Opaque	31	20	64.5			
Red/brown, Opaque	7	4	57.1	5	3	60
Yellow, Opaque	15	2	13.3			
White, Opaque	86	60	69.8	1	1	100
White	1	1	100			
Yellow-Brown	5	1	20			
Yellow-Green, (Opaque)	34	16	47.1	1	1	100
Purple	1	0	0	1	0	0
Nearly colourless	5	0	0			
Total	391	212	54.4	25	20	

Table 9.19 *Rods and rod ends in the Kaupang assemblage. (T) = Twisted. % = Percentage of material that is twisted. Polychr. = Number of polychrome fragments. The colour of the polychrome rods refers to the dominant hue.*

production. One of the aims of this study has been to establish whether these were indeed utilised as raw materials, directly or indirectly through the manufacture of rods (below, 9.4.2–3).

Attention should also be drawn to seven rods made up of heterogeneous opaque red, black and white glass (in different variations). A bead from material that is visually similar was recovered during Blindheim's excavations.

The few examples of rods and droplets of nearly colourless glass (classified as "Other colours" in Figure 9.51) are, with one exception, from the modern ploughsoil. It is therefore difficult to say whether this material should be associated with Viking-age or modern activities at the site.

Only 22 of the twisted rods (5.6% of the total rod material) are bichrome or polychrome. Nearly all of these appear to be from intentionally manufactured reticella rods and not the type of thin, untwisted composite trails used to decorate beads at Ribe, for instance (Sode 2004:figs. 7–8). The large majority of the bi-/polychrome rods combine translucent blue cores with spun opaque white trails. Other recorded colours include blue in combination with trails of white, red, white and red, and yellow; yellow in combination with white or green; and a single yellow, blue, white and red chequered mosaic cane fragment. In general, however, rods from bichrome twisted cables and reticella beads are relatively rare at Kaupang. This is probably a reflection of chronology (below, 9.4.3).

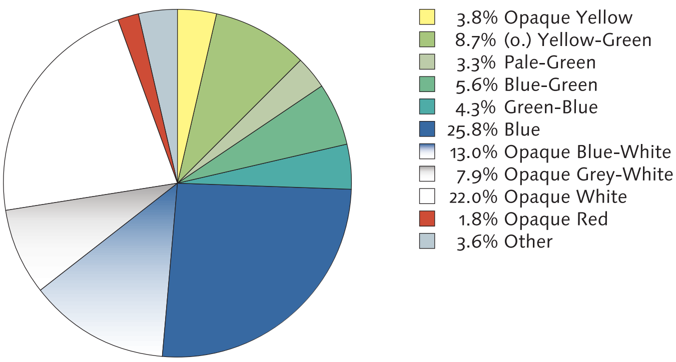


Figure 9.51 *Colour range of rods and rod ends (N=391).*

With regard to the morphology of the rods the material falls into two fairly distinct categories:

- Evenly shaped rods: rectangular, circular or very evenly twisted, with a thickness between 2.5 and 5 mm. The rectangular rods are often slightly flattened, 3–4 mm thick and with a width of less than 8 mm. The rods in this group are often of homogeneous opaque or clear translucent glass. However, a number of small crystalline inclusions (possibly glass paste or crystalline opacifiers that have not been dissolved) are visible in the matrix of the opaque white and yellow specimens.

- Unevenly shaped and twisted rods of opaque glass. Their thickness is more varied (also within the same specimen), although the majority here also fall below 5 mm. The matrix of the rods is often murky, with uneven colouring and lots of impurities in the form of small crystalline inclusions, sand, stains of black ?ironscale (cf. Gam 1991:170, fig.18; Sode 2004:90) and clay coating.

The material is dominated by monochrome twisted rods and rod ends (54.4%). In her study of the Scandinavian beadworking tradition in the Early Middle Ages, Agneta Lundström distinguishes between regularly shaped flat/circular rods and the more crudely twisted specimens (1976:7–10). She suggests that the former represent raw materials or semi-manufactures, while the latter should be classified as waste products. In her study of beadmaking waste from 7th-century Maastricht, Yvette Sablerolles (Sablerolles et al. 1997:303–4) has suggested that only even rods with a circular cross-section should be regarded as imported semi-manufactures and that rods with a near quadrangular or irregular shape were made on the spot through the fusion of thinner filaments to produce whatever rod- (and thus bead-) diameter was required.

The classification of twisted rods as waste from glassworking seems plausible, but Lundström's explanation of *why* they were twisted in this fashion is not convincing. According to Lundström, the finished beads would be separated from the rod by a spinning movement, causing a twisting of the rod. However, the reheating of the rod and fashioning of the next bead should, in my view, have smoothed this effect out, rather than causing an even spiral pattern along the full length of the rod. The twisting should perhaps therefore be related rather to the process of drawing out the rods (for an alternative view, see Wiker, in prep). It is noticeable that the rods often consist of what appears to be a mixture of blue and white glass blended into a pale bluish-white/greyish-white batch. It is not likely that this is the result of remelting evenly twisted bichrome rods. Rather, is it possible that the high number of twisted rods from Kaupang is the result of a specific process of blending colours without the use of crucibles? Although this is an unresolved issue, the practice could be a way of making maximum use of the available glass for the glassworkers or to obtain specific colours that could not be imported. Sablerolles (et al. 1997:297) has suggested that the greyish-blue colour of beads made in Maastricht was achieved from blending imported opaque white and translucent blue glass, although there is no evidence that this involved a twisting technique.

Colour	N
Blue	8
Blue-Green	1
O. Green-Blue	2
O. Grey-Green	1
O. White	1
O. pl. Blue	1
(O.)Yellow-Green	6
Gold Foil	1
Total	21

Table 9.20 *Overview of tesserae from the settlement area at Kaupang. O.=Opaque; (O.)=Semi-opaque.*

Tesserae

Amongst the more specialised finds are a number of complete or halved, small cubes of mosaic glass (Fig. 9.62.cn–co, Tab. 9.20). Similar finds are recorded at several secondary glassworking sites in northern Europe (Pöche 2005:fig. 33, with refs.) and are often associated with the manufacture of glass beads (for recent reviews of the evidence see Gam Aschenbrenner 1999:126–30; Sode 2004:88). Finds of finished beads and melt drops from both Åhus and Ribe with traces of gold foil embedded indicate that gold foil tesserae were remelted for this purpose (Sode 2004:87). Tesserae also appear in other settlement contexts and in graves, and it has been suggested (Lundström 1971:68) that they might have had an amuletic or even specifically Christian connotation for individuals during the Viking Age. Considering the overwhelming evidence for local glassworking and metalcasting documented at Kaupang, there is every reason, however, to relate this material to local workshop activity.

The largest group of tesserae are in various shades of semi-translucent cobalt blue. It is likely that their near opaque appearance is mainly due to encapsulated gas bubbles. Many of the other green-blue, pale blue and white pieces, on the other hand, are truely opaque. Amongst the stratified material, fragments of opaque, heterogeneous yellow-green tesserae are predominant. The most exclusive find is, however, a transparent green-yellow piece, with remnants of gold foil (partially covered by a thin layer of translucent glass) on one surface.

The composition of a number of tesserae and tessera-fragments has been determined by EPMA analysis, and a range of different low magnesium soda-lime-silica glasses, plus one example of a mixed alkali glass, have been identified (Appendix 9.1, KAU 15–21). The use of antimony opacifiers in some of the green (KAU 15 and 16) and blue (KAU 17 and 18) tesserae indicate that these are likely to be of Roman origin. It is well known that antique mosaics were dismantled in the Early Middle Ages to remelt the glass or re-use the pieces in building to emulate Roman splendour (Codex Carolinus 81; Vita Caroli III, 26). At Ribe, it has been demonstrated that Roman tesserae were used as raw material for the production of white glass beads (Henderson 2000:74). Other green and white tesserae (KAU 62–4, C52519/10698) opacified by copper and lead or tin oxide, on the other hand, must be of Early-medieval date. They are probably the products of specialised workshops in the eastern Mediterranean (James 2006:33–47). The mixed alkali example (KAU 21), meanwhile, is more likely to reflect Carolingian production of architectural glass (mosaic cubes and tiles) in the late 8th or 9th centuries (cf. Lobbedey et al. 2001).

Tesserae could also be used in enamels and to colour translucent glass batches. Both these practices are documented by the Benedictine monk Teophilus in his 12th-century treatise on glassmaking *De diversis Artibus* (Liber II, 12 and 59). That this took place in the Viking Age as well is indicated by a number of compositional analyses of window and vessel glass, finds of tesserae on glassworking sites, and through finds of partially dissolved tesserae in glass-melting crucibles in the monasteries of St. Vincenzo al Volturno and Müstair (Kind et al. 2003:82, with refs.). Considering the lack of recorded furnaces and crucibles for mixing glass (above), it is doubtful that the actual colouring of molten glass with tesserae took place at Kaupang (cf. Sode 2004:87). The tesserae that have been recovered from the site may rather have been heated and shaped directly into beads or used for enamel work. One of the blue tesserae and the opaque white cube show evidence of exposure to secondary heating.

Raw glass

The assemblage also includes 72 irregular fragments of raw glass. Seven additional pieces classified as production waste also appear to represent part-melted raw-glass fragments. The largest examples are c. 35 mm across, but most are smaller chips and splinters with no original surfaces preserved. Only a very small proportion of the glass is stratified, and due to the absence of diagnostic attributes it is difficult to determine what proportion of the material represents Viking-period activity and what is more recent. It is, for example, known that gravel containing production waste from the Laurvig glassworks (1872–1926) has been used in road fills in the area (pers. comm. Steinar Kristensen, KHM).

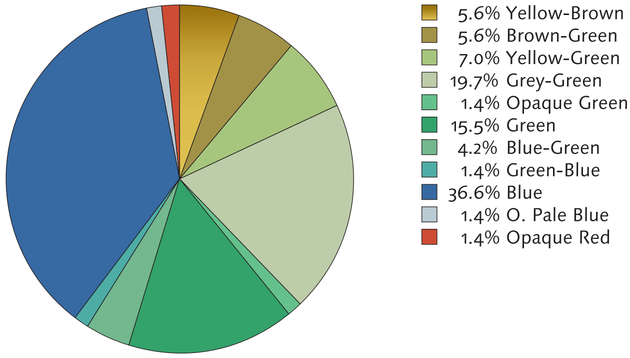


Figure 9.52 *Colour diagram of raw glass fragments (N = 72).*

Generally it has been assumed (cf. Pedersen and Pilø 2007:186) that glass from the Viking-period or later medieval deposits derives from Viking-period activity (a possible exception to this is KAU 4: see Appendix 9.1), while finds from the modern ploughsoil have only been recorded if their colour, gloss and gas bubbles are akin to those of stratified material.

Figure 9.52 illustrates the range of raw glass from the site considered to be of Viking-period date. The material is mainly coloured in different shades of green (58.6%), or blue (37.1%), and is nearly always transparent. Compared to the diagram for rods presented above (Fig. 9.51), there is a conspicuous lack of opaque white and yellow glass.

It is known that raw glass was imported into western Europe during the Early Middle Ages from manufactories in the Mediterranean and Near East (Foy et al. 2000; Whitehouse 2003). From the late 8th century this was supplemented with a more limited European production of potassium-rich glass (material of the latter kind is represented at Kaupang by KAU 5–9, 60–1, 104, 111 and 114–15). Most of the glass was utilised by glass manufactories or glazers on the Continent while some eventually found its way to smaller glassworking sites in Scandinavia where the glass was broken down and remelted. At the site of Åhus I in Skåne, nearly 50% of the c. 70,000 glass fragments excavated to date are from chips and splinters of raw glass. Although it is known that both bun-shaped and hollow glass ingots were imported to Scandinavia (e.g. Callmer and Henderson 1991:fig.

17 I am endebted to Gry Wiker for drawing my attention to this work.

18 A blue tessera has been found in grave Ka. 37 at Nordre Kaupang (see Appendix 9.2).

19 One of the many large chunks of clear blue-green glass with distinct bands of gas bubbles that was found in the modern ploughsoil was sampled for compositional analysis (Appendix 9.1, KAU 13). The glass is characterised by a low total alkali content (13.7%) that would require a high melting temperature and low levels of metal impurities which indicate some form of (modern) processing of the raw materials. It is therefore likely that the material is modern. Similar examples were excluded from the assemblage on this evidence.

2; Pöche 2005:pl. 10.19–20), very few fragments of raw glass with preserved original outer surfaces have been recorded at Kaupang. A blue fragment with one convex side (C52264/5 [1013]), might be from a bun-shaped raw-glass cake, like those recorded from Åhus. The distinct lead-potassium-silica composition of other dark brown-green pieces suggests they are more likely to be fragments of linen-smoothers (see 9.3.2).

The use of raw-glass chunks and specialised glass ingots as a source of glass in Early-medieval Europe was briefly discussed above (9.3.2). It was pointed out that both coloured ingots and raw-glass chunks circulated and were used by glass manufactories and for small-scale glassworking. It seems likely that artisans present at Kaupang procured the selection of coloured glass necessary for their craft whenever and in whatever form available, and brought this with them. The working of blue and green glass must have depended to some extent on small chunks of raw glass or possibly, in the case of blue glass, on ingots that could be chipped and re-melted as required (below, 9.4.3).

Fragments of window glass and vessel sherds

In her preliminary assessment of the material from Blindheim's excavations, Hougen (1969a) proposed that the heterogeneous character of the vessel assemblage indicated the importation of vessel sherds to the site as raw material for glassworking (for similar assessments of material from Hedeby and Helgö, see Jankuhn 1986:199 and Lundström 1976:10).

To this can be added that the few recovered fragments of *window glass* from Skre's excavation are unlikely to represent architectural features of the buildings in the settlement (9.3.1). They could have been imported to produce inlays or as raw material for beadworking. Some of the pale green wasters and finished annular beads have a matrix that visually resembles a number of the thicker window-fragments. Most of these beads and wasters are unstratified, however, and only a small proportion has been sampled to investigate compositional similarities. It is therefore difficult to determine how much of this material was really used for bead production (below, 9.4.3). Some of the darker window-fragments could theoretically have been used to colour glass melt too, although there is no evidence for this at Kaupang.

With regard to the *vessel assemblage* published here, it has been argued above (9.2.6) that it *mainly* represents complete vessels broken on the site, and not imported cullet. This, however, does not exclude the possibility that a small proportion of the material was brought to the site as scrap, or that vessel-fragments were collected for recycling after breakage. Small and large caches of glass cullet intended for recycling are known from other Early-medieval glassworking sites, but also from craftsmen's graves and metalworking hoards (e.g. Hinton and White 1993; Filippucci 2001:336–8, pl. 12.2, nos. 42–54; Mortimer and Heyworth 2004; Pöche 2005:106, tab. 7). At the *Posthus* site, phases with beadmaking workshops also saw increased deposition of vessel sherds, and sherd material and beadworking waste have been found together in one of the beadworking horizons uncovered in Kunstmuseets Have (Sode 2004:88; Lund Feveile 2006:240). At Groß Strömkendorf, Alexander Pöche (2005:103–8, figs. 47–51) has been able to demonstrate that at least some concentrations of melted vessel-fragments correlate spatially with other glassworking waste.

To determine whether vessel glass was used as raw material for beadmaking at Kaupang, I have considered several aspects of the glass-vessel assemblage: anomalies in the composition of the assemblage; the presence of archaic vessel-types, and heat-exposed material; and the chemical composition of the glass.

Anomalies in the profile of several glass assemblages have in the past been taken to indicate that certain elements of the live assemblage were de-selected prior to deposition for purposes of glass recycling. Large and thick base-fragments may have been removed because they are particularly suitable for recycling (Hunter and Heyworth 1998:59; Gam Aschenbrenner 1999; cf. 9.1.1 and 9.2.3) and decorated sherds might have been left behind on a site because polychrome material would destroy the purity of the recycled batch (Hunter and Heyworth 1998:60). It has also been speculated that differences in sherd-size may reflect attitudes to recycling (e.g. Lundström 1976:10; Stiff 1996:301–2, 2001:44–5). Large fragments would presumably be removed first because they provide the easiest access to glass.

With the vessel assemblage from Kaupang it is difficult to relate variance in these parameters to glass recycling. Although the number of funnel bases, both in Skre's and Blindheim's settlement assemblages, is limited, this is mirrored at many sites (e.g. Pöche 2005; Lund Feveile 2006), and it is difficult to conclude that it requires a specific explanation. Although the frequency of decorated sherds is slightly higher at Kaupang than in late 8th- and early 9th-century layers at the *Posthus* site in Ribe (9.2.1), this has probably more to do with chronology and typological developments than a deliberate pre-depositional selection process. The majority of the recovered vessel-fragments are undecorated, monochrome sherds that, according to Hunter and Heyworth, would have been the easiest to recycle. Although there is a lack of sherds above 30 mm in length in the stratified Viking-period deposits at Kaupang, and significantly few larger fragments in the later medieval plough-layer assemblage (Fig. 9.43), it has been argued above that this is a function of redepositional activity, not of recycling.

The best argument for the possible importation of cullet to Kaupang may be the small number of odd single sherds not associated with any of the Sherd Families. It is nevertheless difficult to establish if this is just because additional fragments lie outside the narrow limits of the excavation trenches. The argument would be considerably strengthened if it were possible to show that these sherds are in any way morphologically different.

Lund Feveile has suggested (2006:237–8) that old vessel material, and material brought to the workshops from places of consumption to be recycled (tertiary waste in her terminology) may be recognised by worn surfaces or scratches. The scope for identifying such material is limited, however. The marked increase in vessels with scratched surfaces in the modern ploughsoil at Kaupang must be attributed to ploughing rather than pre-depositional factors.

The scope for identifying fragments from vessel-types that pre-date the established period of occupation should be better. Both Stiff (1996:296) and the present author have observed a small number of sherds from archaic vessel-types amongst Blindheim's settlement finds. Examples are D63/q, identified both by Hougen (n.d.) and Stiff as a claw from a late claw-beaker, and A63/3ø, which Stiff identifies as a bowl of the same type as one in Valsgärde grave 6. Both sherds are provisionally dated by Stiff (1996:296) to the late 7th century. To these one can add MO67/ee, a thin-walled, very light green-blue sherd with thin, horizontal self-coloured trails that are not melted into the wall (personal observation, KHM). These characteristics are replicated in 6th- or 7th-century claw-beaker sherds from Borg (Henderson and Holand 1992:pl. 1B).

From Skre's excavations, potentially archaic material includes two sherds with body-coloured trailing discussed above (9.2.2, Fig. 9.9.a–b); a tall palm cup or early funnel beaker (C52519/11019); and possibly another bag- or claw-beaker (C52519/16470). The assemblage also includes two externally folded tubular cavity rims (Type 1a). One (C52519/10288) is from a bowl similar to that in Valsgärde grave 6 (9.2.3), while the shallow fold of C52519/22789 is usually associated with 7th- or 8th-century (tall) palm cups (Stiff 1996:51–2; Näsman 1986:74).

Although there is considerable uncertainty with regard to the continuous production and circulation of these vessel-forms in the early Viking Period, it is possible to conclude that there is a small number of archaic-looking vessel-fragments amongst the sherds from Kaupang. These *could* represent scrap glass imported to the site in a fragmentary state. It is, however, difficult to show that any such material actually was remelted and turned into beads. Similar to Blindheim's assemblage (Hougen 1969a:128), there is only limited evidence in the present assemblage for vessel sherds melted or deformed from secondary heat. Some of the sherds are likely to have been melted because they were deposited close to hearths or due to accidental fires. C52519/18683 (Fig. 9.62.p) is a melted sherd belonging to SF 12 recovered from floor deposits close to the hearth in building A301; C52264/816 and /976 are melted and folded blue *in calmo* rim sherds from the modern ploughsoil; and C52516/3616 (Fig. 9.62.m) consists of two undiagnostic dark green vessel sherds that are melted and deformed with a cracked and part slagged surface caused by strong heat.

On the other hand, a small number of sherds display attributes that may well be associated with workshop activity. Of particular interest is a dichroic purple-brown vessel sherd from Plot 2A with white marvered trails (C52519/19473). One end of the fragment is melted and twisted, as if someone had tried to draw out a glass trail (Figs. 9.53, 9.62.o). Two further sherds from Plot 2A show signs of heat exposure. C52519/21782 is bent and displays what looks like a tool-mark on the convex side, while the shape of C52519/23450 (Fig. 9.62.n) appears to have been deformed by heat although it has kept its gloss and clarity.[20] There appears to be a concentration of heat exposed vessel finds in this area although this is not one of the plots with very much beadworking waste or metalworking activity (below, 9.4.2).

Of equal importance are a small number of rods, rod ends and production waste of very light green or blue glass. Although some of the undiagnostic pieces may be modern contaminants, there are others that certainly represent Viking-period glassworking. The glass matrix in some cases is visually very similar to what is seen in vessel-fragments. Because most of this material has been recovered from the modern ploughsoil, it has however not been subjected to chemical analyses which might have demonstrated that the glass is compositionally similar to that of glass vessels (below, 9.4.3).

Opinions are divided on whether vessel sherds would be at all suitable as a raw material for beadmaking. I have referred above (9.1.2) to the experimental work carried out by Tine Gam Aschenbrenner that showed that vessel glass is not very well suited unless one can completely dissolve the glass in a furnace (Gam 1991). Later attempts at making beads from melted Roman vessel sherds (Gam Aschenbrenner 1999:124–5) resulted in heterogeneous, layered beads with gas bubbles trapped in the matrix. A small number of beads from 8th-

20 To these can be added the edge of a thick blue-green window pane (C52519/10165) that has melted edges and a possible tool-mark.

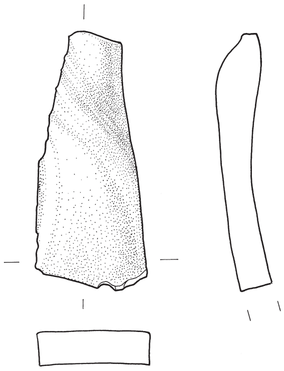


Figure 9.53 *C52519/19473. The left-hand side of the vessel sherd has been twisted and drawn out. (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 9.54 *Typical raw materials, production waste and finished beads from SP I, Plot 1A. Photo, Eirik Irgens Johnsen, KHM.*

Figure 9.55 *Production waste from beadmaking and melted vessel sherds from deposits dated to SP I. The colour of the symbols replicates that of the finds. Map, Elise Naumann.*

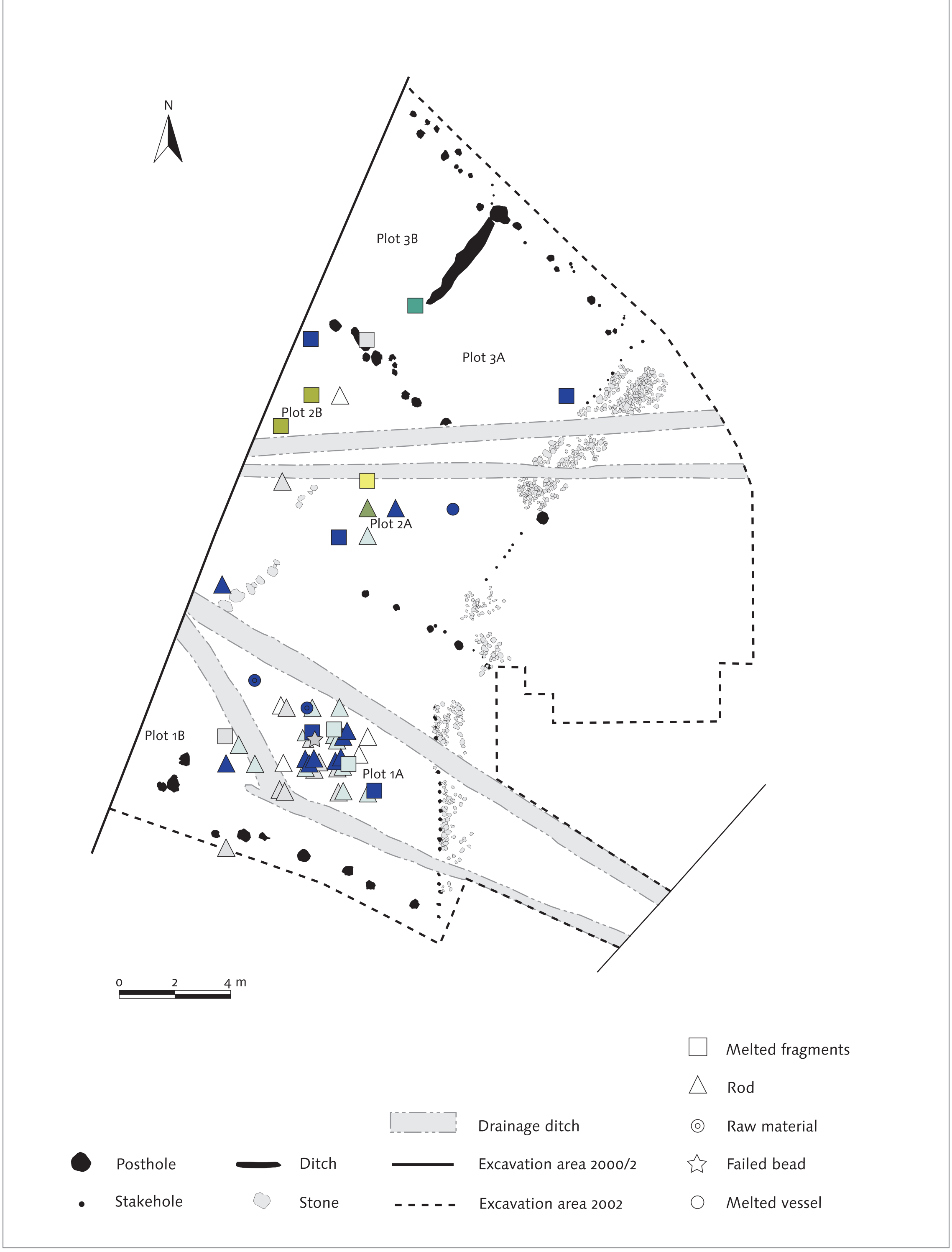
century layers at Ribe with similar attributes are thought by her to reflect such production.

A very different explanation for these distinct beads could be that the working temperature of the glass was too low and that the different layers of glass would therefore not fuse properly when wound around the mandrel (Dungworth et al. 2007:4; Wiker, in prep.). Julian Henderson has pointed out that the modern glass Gam Aschenbrenner used in her initial experiments required a significantly lower melting temperature than the Early-medieval soda-lime-silica glass analysed from Ribe (Henderson 2000:74–6; Gam 1991:tab.1). Gam Aschenbrenner recorded temperatures of around 900° C (1991:169) at the surface of the glass crucibles she heated on an open hearth with the help of artificial draught. These temperatures would not, according to Henderson, be high enough to melt Early-medieval soda-lime-silica glass completely. The fact that the use of Roman glass in Gam Aschenbrenner's later work (presumably with working properties more akin to the glass remelted at Ribe in the 8th century) resulted in layered beads suggests that the temperature may at least be part of the explanation.

Beads with a layered matrix like those described by Gam Aschenbrenner are rare at Kaupang (Dungworth et al. 2007:3; Wiker, in prep.) They are nearly always made from transparent (pale) grey-green glass. Although this resembles the glass matrix in some of the sherd material as well as rods from the site, it is difficult to relate these categories of find to one another spatially or chronologically, since the beads do not occur in the stratified deposits of the MRE excavation. On the other hand, the distinct colour of the beads and the likelihood that they derive from late 9th- or 10th-century activity suggests a third possible explanation for their appearance: that it is the glass composition itself that makes the beads prone to decay. Compositional analyses carried out using EDX to determine this, found a correlation between matt and dulled glass in beads and wasters and the presence of potassium used as a flux in the glasses (Dungworth et al. 2007). A similar change towards potassium-rich glass has not been detected in the vessel sherds analysed, and only in raw-glass fragments. This suggests that vessel glass was not the source of the analysed glass (below, 9.4.3). However, the limited number of analyses and the biased sample selection leaves it unclear how representative these results are for the Kaupang assemblage as a whole.

9.4.2 Spatial relationships between the artefact-groups

Glassworking waste can be found scattered throughout the MRE area as the result of constant trampling, redeposition and levelling. There are nevertheless clear differences in frequency of finds from plot to

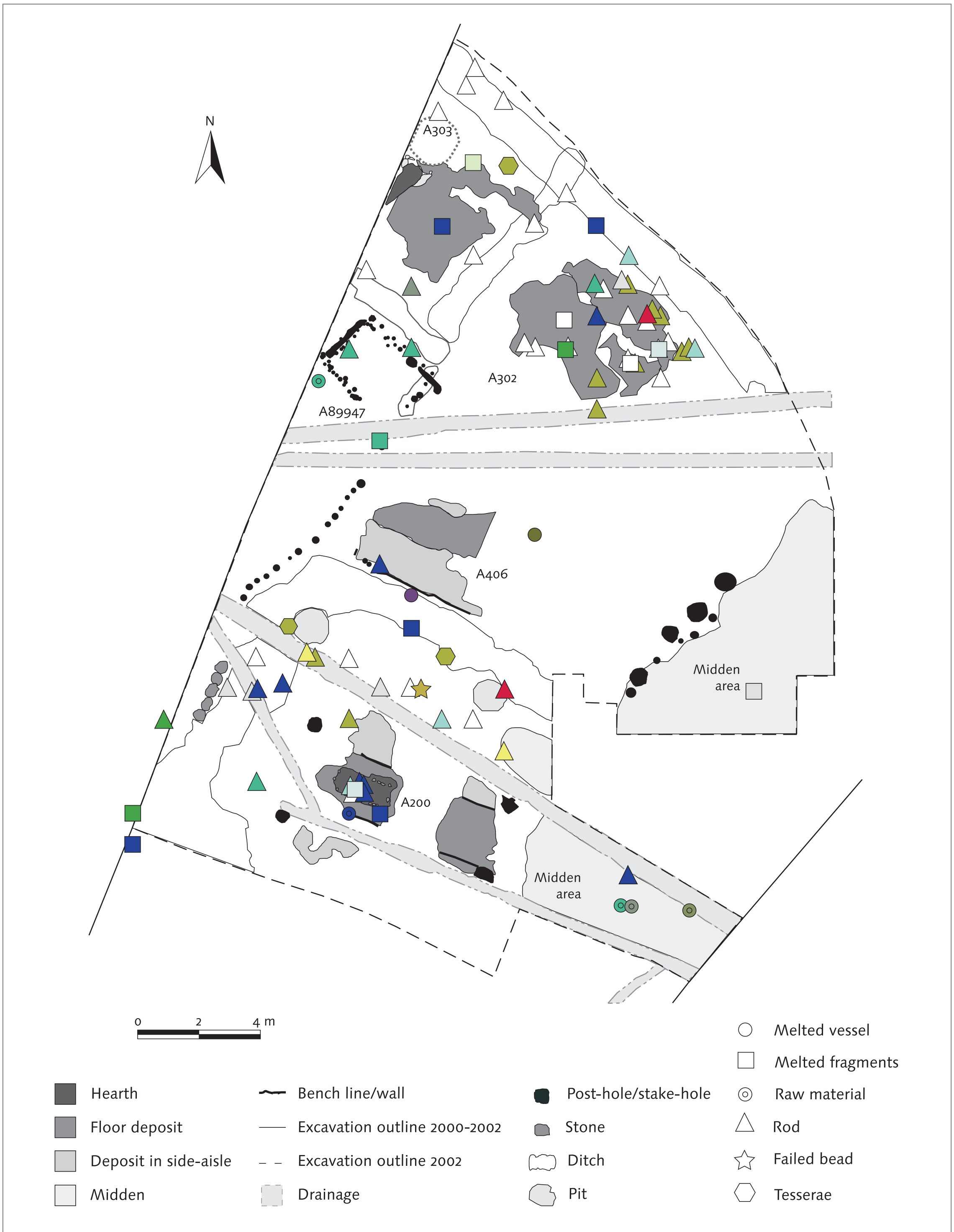


plot, with significant concentrations in SP I and II:1 (Figs. 9.26, 9.40). These concentrations must in my view be taken as evidence of individual episodes of beadmaking. To clarify which raw materials apart from the rods were used for beadmaking in these events, the spatial relationship between the different groups of glassworking material, their colours and their chemical composition have been explored.

SP I

More than fifty rods, rod ends, raw-glass fragments and other waste materials from bead manufacture has been recovered from SP I deposits (c. AD 800–805/10). A particular concentration of translucent blue and opaque white production waste was uncovered on Plot 1A together with several undecorated annular wound beads in corresponding colours (Figs. 9.54–5). Although one might have expected some green beads, the beadworking technique and colours are typical of Scandinavian products of the late 8th century according to Callmer (2003:44). A limited number of small opaque yellow and transparent yellow-green melt drops from Plots 1A and 2A are probably material intrusive from SP II activity (see below).

There were hardly any wasters on any of the neighbouring plots, and Plot 1A appears to have been the only excavated plot on which beadworking took place in SP I. No intact workshop horizon or hearths have been recorded, however. The character of the



soils and the bone material indicate that the workshop activity took place outdoors (Pilø 2007d:195). Stake-holes visible against the subsoil suggest a number of possible tent lines or windbreaks, but these structures cannot directly be connected with the glassworking episode.

Three fragments of dark blue raw glass and an extensive assemblage of blue and white rods indicate that the beadmakers relied upon these raw materials. Compositional analyses of material from SP I, as well as residual SP II:1 material from the same plot, confirm this relationship (Appendix 9.1). Nearly all the *translucent blue* raw glass, rods and beads that have been analysed are from cobalt-coloured, low-magnesium soda-lime-silica glass. Optically the materials appear identical. Elevated levels of antimony in all the samples indicate that the glass had been coloured by the addition of Roman tesserae. The majority of the *white* glass appears to be opacified with tin compounds although some bright

Figure 9.56 *Production waste from beadmaking, tesserae and melted vessel sherds from deposits dated to SP II:1. The colour of the symbols replicates that of the finds. Map, Elise Naumann.*

white rods and bead-fragments contain antimony. Very few of these rod-fragments are of the smooth quadrangular type Lundström suggested could be imported semi-manufactures. Some porous and chubby "rod"-like fragments (e.g. C52519/29033 and C52519/26470: Fig. 9.54, left) indicate that larger blocks of glass could have been imported and broken up. These fragments are 1–2 cm thick and consist of several filaments with a longitudinal structure. Similar white lumps have been found in Ribe (e.g. Jensen 1991:38, picture, bottom right). Although some of the material from Plot 1A appears to be a blend of blue and opaque white glass, it has not been possible to demonstrate this compositionally.

Although several vessel sherds were recorded from SP I (one of which is partially melted) these are made from lightly tinted translucent glass while the beadworking waste is opaque white or deep cobalt blue. EPMA analyses confirm that the vessel-fragments are compositionally distinct from the raw glass, pre-fabricated rods, wasters and finished beads, with much lower levels of metals associated with colouring agents (below, 9.4.3). It is therefore unlikely that vessel sherds were utilised as raw materials for bead production in SP I. Nor can any tesserae be related to this activity horizon.

SP II:1

Glassworking probably continued in some of the MRE area during SP II:1 (Fig. 9.56). More than 80 waste-fragments have been recovered from deposits from this Site Period, but interpretation of their distribution is complicated by the fact that much of the material must be residual. There is a noticeably higher green component compared with the, colour-wise, restricted SP I finds. The range of material is also wider, with fragments of raw glass, tesserae and window glass, as well as some molten vessel sherds potentially associable with bead manufacture.

The waste forms two main concentrations. On Plot 1A, blue and opaque white material continues to be present. There are also a few opaque yellow rods, blue-green and green raw glass chips, as well as yellow-green rods and tessera-fragments. The material appears nevertheless not to be associated with the accumulated floor surfaces and building remains recorded on the plot (apart from stray finds embedded in soils used for construction), and the material is too small and disparate to say anything meaningful beyond that it derives from glassworking close by or during earlier occupation events.

The other cluster of finds that seems significant is that from Plot 3A. The material consists mainly of yellow-green production waste plus a relatively large number of white rods, but it is difficult to conclude unequivocally that glassworking took place here. During excavation, the deposits were perceived to have accumulated in an outdoor activity area with poorly defined layers consisting of a sandy mix of charcoal and organic material as well as refuse and waste from various crafts. Micromorphological analyses of the soils have nevertheless indicated that the deposits accumulated inside a very poorly preserved building without a hearth. The glassworking waste was concentrated in the eastern part of this structure (A304).

The absence of a recorded hearth or furnace constructions and the concentration of wood and bark tissues in the floor matrix of A304 may suggest that this part of the building served as an outhouse or a woodworking area (see Milek and French 2007:344–6). It is difficult to see this as a likely environment for glassworking, and no microscopic glass droplets or splinters could be observed in thin sections of the floor accumulation that were analysed (Pilø 2007d:207; pers. comm., Karen Milek). Although a significant amount of residual beadworking waste was also embedded in later building structures in this area (A302: SP II:2), it is difficult to determine whether the material from A304 is from a disturbed glassworking horizon or brought into the building by foot from nearby areas.

SP II:2, SP III and SP I–III contexts

There is a drastic reduction in material connected with glassworking in SP II:2, both numerically and in proportion to the vessel assemblage (Fig. 9.26). The range of finds largely mirrors earlier activity (although note the finding of a blue-green tessera on Plot 3A), and the contexts indicate that much of the material is residual. Several fragments are from the build-up of the hearth in building A302 (A64768). There are also remains of a dumping event in the passage between Plots 2A and 2B (AL61538) and several finds (not exclusively production waste) from the fill between Plots 3A/B and 4A/B (A63192). There are, however, no primary activity layers

Colour	Rods		Tesserae		Raw glass		Vessel glass (heat-exposed)		Windows/ inlays	
O. Yellow	X	S								
O. Yellow-green	X		X	S						
Yellow-green	X	S		S	X		X	S	X	S
O. Grey-green			X							
Grey-green	X	S			X	S			X	
O. Green					X					
Green	X	S			X		X	S	X	
Blue-green	X	S		S	X	S	X	S	X	S
O. Green-blue			X	S						
Green-blue	X	S				S	X	S	X	S
Blue	X	S	X	S	X	S	X			
O. Pale blue			X		X					
O. Blue-white	X	S								
O. Grey-white	X	S								
O. White	X	S	X							
White	X	S								
Colourless	(X)						(X)	S		
Gold foil				S						
Purple	X									
Brown-purple								S		
Brown							X			
O. Red	X	S			X					
Black	X									
(Yellow-brown)	(X)				(X)		(X)			
Brown-green					X	S				S

Table 9.21 *Synopsis of the range of colours and types of material identified at Kaupang. X = from the later medieval plough-layer or modern ploughsoil. S = Represented in stratified Viking-period contexts. (X) = Finds of uncertain date.*

associated with these finds. Linked fragments (e.g. C52519/25908 and C52519/25170) also indicate that some material preserved in SP III features represent SP II:1 activity.

Much less glassworking waste has been recovered from the deposits north and east of Plot 3A. The dearth of finds may indicate that glassworking did not take place in this part of the MRE site, or that the excavated deposits accumulated at a time when such craft activities were not being practised (cf. 9.2.5 and 9.5.1).

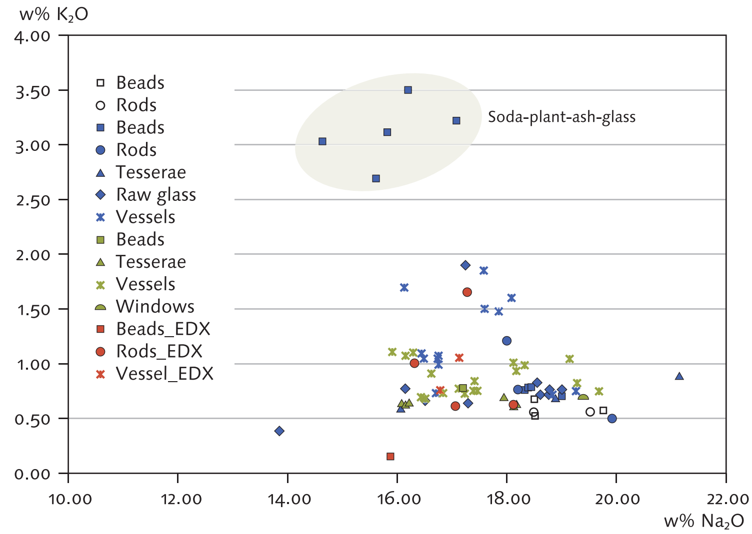
9.4.3 Chromatic and compositional relationships: conclusions

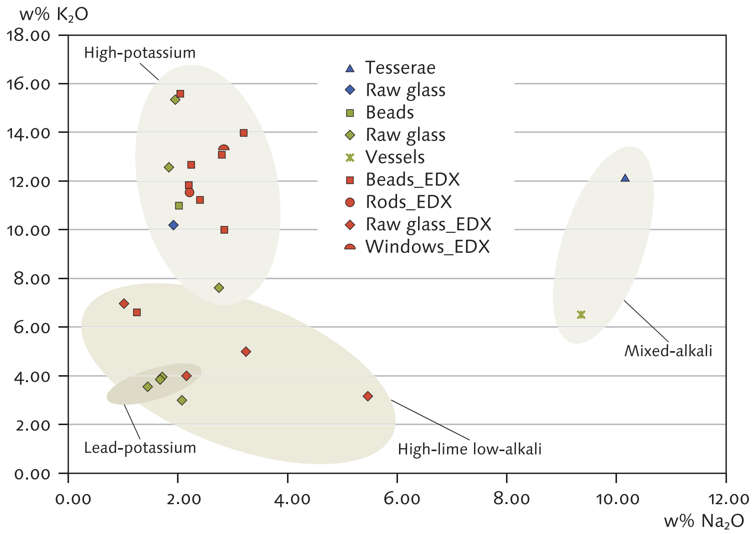
The different materials associated with beadworking are found in many different colours. While a large part of the rods and rod ends are made from opaque glass, the raw glass, vessel sherds and window-fragments are largely transparent (cf. Figs. 9.3, 9.51 and 9.52). The range of colours in stratified contexts provides some indication of the selection of raw materials for beadmaking in the early 9th century (Tab. 9.21). Sixty-six rods, locally produced beads, tesserae and fragments of raw glass were also subjected to EPMA and EDX analysis to explore the chemical relationship between the different material groups. These results were also compared to the results of analysis of 46 imported beads, vessel sherds and window-fragments (Figs. 9.57–8).

Table 9.21 illustrates that stratified finds of opaque yellow, blue-white, grey-white and white glass are limited to rod and rod ends, perhaps indicating that the production of beads in these colours was based upon imported semi-manufactures of this kind. All the samples are of low-magnesia soda-lime-silica glass (Fig. 9.57, Appendix 9.1). Analyses show the yellow and red glass (not illustrated here) are coloured with lead stannate and cuprous (Cu^{+}) copper crystals respectively. Four of the white samples were coloured with tin-lead oxides. A small

Figure 9.57 *Bi-plot of sodium and potassium oxides in white, blue and green soda-lime-silica glasses from Kaupang. The green glass that has been analysed by EDX rather than EPMA is labelled separately.*

Figure 9.58 *Bi-plot of sodium and potassium oxides in blue and green potassium-rich glasses from Kaupang. The green glass that has been analysed by EDX rather than EPMA is labelled separately.*





number of larger rods from several filaments may also indicate that white rods could have been drawn from larger lumps of glass. The source of one antimony-coloured white annular bead has not positively been identified, but the recovery of a partly melted white tessera (not analysed) suggests that some of the white glass could have been obtained from Roman mosaics, as has proved to be the case in Ribe (Henderson 2000:74).

There is a considerably wider range of artefact-types present in transparent glass. Dark blue material is found in raw glass and tesserae, in addition to rods. As noted above, the composition of the raw glass corresponds closely to that of the rods and the locally produced annular beads, and the glass is, chemically, clearly distinct from what is found in a number of imported soda-plant-ash beads (KAU 50 and 91–4; Callmer 1977:types F061, E060 and F051). This suggests that the local blue beads were manufactured from raw glass that was melted down at Kaupang. Whether the imported raw materials also comprised pre-fabricated rods is difficult to determine.

The elevated potassium content in a blue rod (KAU 33) and a raw glass fragment (KAU 1) is noteworthy. It indicates that the glass has been mixed with soda-plant-ash or potassium-rich glass. That the same tendency is seen in several vessel samples suggests that this blending took place in western Europe before the glass reached Kaupang. The finds indicate that the blue glass imported to Kaupang was more varied than the beads and rods analysed from SP I and II at first suggest. There is, however, no evidence that vessel-fragments were used to supplement the raw material. All the vessel glass analysed shows significantly lower levels of elements associated with colouring agents such as copper, antimony, lead or cobalt.

Although the green rods constitute the smallest group of beadworking waste (17.6%), the fabric appears to be the most heterogeneous with regard to colour shades and glass quality. The high proportion of green raw glass (58.6%) should be noted. It seems likely that much of the beadworking in this colour must have been based upon imported raw glass. The analysed green glass includes both soda-lime-silica glass (Fig. 9.57) and potassium-rich glasses (Fig. 9.58). The raw material for green soda-lime-silica beads has not been identified. Significantly, there are no green raw-glass fragments of this composition, and the tesserae sampled have higher levels of antimony and magnesia and lower tin contents than green wasters.

It is difficult to relate the finds of tesserae to the beadworking, either chemically or spatially. Although both white and blue tesserae have been recovered, and two of these were part-melted, there is a palpable absence of such material from contexts where these colours were worked. The most suggestive evidence is probably the finds of yellow-green tessera-fragments in SP II:1, which is contemporary with the first occurrence of rods in the same colour, but only on the next plot but one. Compositionally, however, these finds are not identical. Keeping in mind the significant problem of redeposition, one should not put too much weight on this limited number of finds. However, many tesserae are clearly *not* from areas with concentrations of glassworking waste. Both tesserae and other raw glass could, of course, have been used for other jewellery production too; perhaps most obviously for enamelled inlays (Lundström 1976:11). This technique is, however, largely confined to pre-Viking-period material in Scandinavia, and one would not expect such craftwork in the early 9th century. Most likely the tesserae are to be related to beadworking (although it is not possible to demonstrate this), while some of them could have been removed from the workshop context and have taken on the form of keepsakes within the wider population.

There is considerably closer correspondence between potassium-rich beads, wasters and raw glass (Dungworth et al. 2007). In the group of *high-lime low-alkali glass,* the linear alignment of the raw glass (KAU 104, KAU 111 and KAU 115) and the bead analysed (KAU 106) suggests a mixing line, and that they originate from the same production process. Individual element oxides vary considerably, however, and indicate that the glassmakers had poor control of the raw materials. In the *high-potassium group* there is a reasonable correlation between a melt-fragment (KAU 101) and a number of beads (KAU 95, KAU 105 and KAU 113). The composition of the samples fluctuates without any marked peaks, and the material indicates that working of this quality of glass took place at Kaupang. A raw-glass fragment from the same area of the plot (KAU 60) can be distinguished through its raised levels of antimony and lower levels of manganese, aluminium and phosphorus.

The matrix of much of the waste material resembles that of vessel glass, and it is entirely possible that vessel-fragments or windows could have been used to eke out the glass available to the beadmakers even though this cannot be fully demonstrated. Both the EPMA and EDX analyses show consistently lower levels of copper, tin, antimony and lead in vessel-fragments than in green rods and beads. There is close proximity between one EDX-analysed window-fragment (KAU 103) and a bead (KAU 99). A high lead peak (1.4%) in the window glass is not replicated in the bead, however, but the sample material is so decayed that it is not certain that this difference is due to uneven dispersal of metals in the matrix.

To conclude: the amount of glassworking waste and raw material fragments recovered at Kaupang is relatively small, and very few workshop implements have been identified. The two possible crucible-fragments are untypical of other known Early-medieval examples and do not confirm that crucibles were employed to melt glass at Kaupang. Although Gam (1991) has questioned whether crucibles were at all necessary for beadmaking, their absence indicates that the bead production at Kaupang was limited and largely based on pre-coloured material in the form of rods, raw glass and tesserae. According to Torben Sode (2004:87), it is likely that the bead makers in 8th-century Ribe were able to colour the glass through the addition of tesserae, crushed glass or glass frit with a high content of metallic minerals (cf. Henderson 1999:84). The accuracy of Sode's assumptions with regard to the Ribe material aside, the lack of recorded furnace structures and crucible-fragments at Kaupang does not support a similar interpretation here. Most of the material probably arrived ready-coloured from factory sites in the Middle East or western Europe, although it is also possible that some semi-manufactures were imported from larger secondary workshops in Scandinavia (e.g. Hedeby or Ribe). A possible exception is the bluish-white glass, which may have been modified through the admixture of translucent blue and opaque white glass at Kaupang.

Nor has it been possible to demonstrate that vessel sherds were remelted for bead production at Kaupang, although there are both several historical references to the re-use of waste glass and such practices are recorded in modern Middle Eastern beadmaking workshops (Sode 2002:119, 2004:87). Without the use of proper furnaces in which the cullet could be melted down and blended at high temperatures it would be difficult to control both quality and colour of the glass. Gam Aschenbrenner's experimental work suggested that sherds formed into beads directly would produce beads with a heterogeneous, layered matrix, numerous trapped bubbles and surface scars (1999:124–6). Although a small number of beads likely to have been produced at Kaupang may resemble such material, these appear to be of a compositionally distinct potassium-rich glass (Dungworth et al. 2007; Wiker, in prep.). No vessel glass of the same composition has been identified at Kaupang. A small number of glass wasters with a matrix similar to that of vessel and window glass suggest that such material *could* have been used as a glass source for the beadmakers, but this has not been conclusively demonstrated chemically, and can hardly have made up a large part of the raw material.

The waste material attests to the manufacture of transparent blue, green and opaque white annular beads in SP I and, less securely, SP II:1 of the MRE excavation. The bi- or polychrome material is very small (7.1%), and in the early 9th-century deposits (SP II:1 and 2) limited to twisted rods (reticella cables). Of the 42 fragments, 13 are melt lumps and irregular rod ends that cannot be classified with certainty, two are failed imported beads (Callmer 1977:type G050), and 22 are twisted bichrome (reticella) rods. There are only four composite rods intended as applied bead decoration and a single find of a mosaic cane.

The near absence of rods and beads related to the mosaic or reticella techniques or fused polychrome trails for applied decorations has implications for the dating of the activity. On 8th-century sites like Ribe and Åhus the percentage of polychrome waste material seems to be significantly higher (Näsman 1979; Callmer and Henderson 1991; Sode 2004). Available data from the 1970's excavations in Ribe, principally Kunstmuseets Have (4M75) and Dommerhaven (5M74), show that 41% of the rods and 14% of the abandoned production waste and raw materials there were polychrome (Näsman 1979:fig. 9). Both the morphology of the Kaupang material and the dating of SP I (c. 800–805/10) and II (c. 805/10–840/50) correlate closely to beadworking material and techniques in the last decades of the 8th or very early 9th centuries (Callmer 2003:44). It is not unlikely that much of the polychrome material arrived unintentionally at Kaupang, along with packages of imported beads (cf. Callmer 1991:32–3).

Local beadmaking nevertheless appears to have been short-lived. There is a gradual reduction in material associated with glassworking during SP II, and I argue that most of the SP II:2 and SP III waste is residual. This might, of course, be a very local phenomenon, limited to Kaupang, or even to the few plots excavated by Skre's team.[21] Nonetheless, it corresponds with broader geographical patterns. Throughout Scandinavia, local beads were increasingly replaced by imported drawn, segmented or cut beads (Callmer 1977:types E and F) during the first three decades of the 9th century (Sode and Feveile 2002:7–9, fig. 3; Callmer 2003:44–5; Wiker 2007). The provenance of this material is debated, but it is generally assumed that it reached Scandinavia through central or Eastern Europe (Callmer 1991, 1995; Wiker, in prep.). Analyses of imported beads of Type E060, F051 and F061 from Kaupang (KAU 50, 91–4) show that the soda-plant-ash glass in the beads has at least two different origins: one early Islamic (Syrian) and one that is as yet unlocated (Gaut et al., in prep.). The massive influx of imported beads led to a significant reduction in domestic Scandinavian bead production: a shift that correlates neatly with the observed reduction of beadworking waste at Kaupang during SP II.

Scandinavian bead production was revived in the last decades of the 9th century, with the reintroduction of wound green, opaque white and opaque reddish brown beads (Callmer 2003:45). No undisturbed deposits of this date, however, are preserved in the MRE trench. It is possible that the recorded green, high-potassium and high-lime, low-alkali raw glass and beads from the later medieval and modern plough-layers represent late 9th- or early 10th-century glassworking at Kaupang (Dungworth et al. 2007; Wiker, in prep.).

9.5 Conclusions and discussion

The final section of this report widens the scope of the discussion and attempts to place the assemblage in a larger geographical and social context. After briefly revisiting the main conclusions that can be drawn so far, the origin of the Kaupang glass is addressed, together with the site's position in a distributional network and its relationship to its hinterland. Conclusions are drawn from typological studies, distribution maps and compositional analyses, as well as from an analysis of production and exchange in the North Sea area prepared by the author (Gaut, in prep.). The discussion will focus on the origins of the glass objects and only to a limited extent on the fabrication of the glass itself. The reader should also note the distinction made between vessel material and the raw materials for glassworking when exchange mechanisms are concerned. Finally, the argument turns to the overall availability of vessel glass at Kaupang and the social context of the consumption.

The material from Kaupang provides a valuable insight into the availability of glass in Scandinavian coastal market towns during the early Viking Age. In particular, the stratified early 9th-century material from the *MRE* 2000–2002 has allowed for a detailed consideration of the way glass was used and formed part of the material culture. Typological, spatial and chemical analyses show that the majority of finds represent two unrelated activities: the local consumption of vessel glass, and beadmaking (cf. 1.1; Lundström 1981:19–22).

21 It may be questioned whether beadworking would take place in the middle of the densely occupied core area of the settlement in Site Period II. Glassworking and other high-temperature crafts may have taken place on the outskirts of the settlement or at least in purpose-built structures – none of which were uncovered in the MRE area (Pilø 2007d). Besides, the model of itinerant artisans (below, 5.1) does not sit comfortably with what is known about tenurial arrangements at other Continental specialised production- and market sites, where it would appear that plots with permanent buildings were generally let on a more permanent basis (Gaut, in prep). Short-term seasonal visitors were more likely to have been billeted in open areas if they could not rely on kin, friends or (in later periods) guild members to house them. Unless one assumes that the glassworkers were permanent residents at Kaupang – and there is little to suggest this – this circumstance would again direct their activities towards the periphery of the site.

- The *vessel material* predominantly represents vessels used for drinking within the buildings excavated on the site. The *estimated minimum number* of vessels broken and deposited at or around five excavated plots 1A, 2A, 2B, 3A, and 3B in the 50-year period from c. AD 800–840/50 is 32–34. A large additional number of undiagnostic light green and blue sherds indicate, however, that the total number of vessels in the deposited assemblage must have been considerably higher: probably closer to 50. Some statistical extrapolations with regard to the availability of glass on the site as a whole and a discussion of the social context of consumption will be presented below.
- Both the number of identified fragments and calculations based on estimated minimum numbers of vessels suggest that the *vessel-forms* most frequently in use on the site were funnel beakers and small jars (Fig. 9.59). While the proportion of brightly coloured and decorated jars is likely to be somewhat overrepresented, the near absence of bowls *may* be caused by the difficulty of identifying such fragments.
- The glass vessels are of types commonly found in western Europe in the 8th–10th centuries (Tab.9.22). Identified *vessel-types* include undecorated and ribbed *tall palm cups/funnel beakers*; *funnel beakers* with marvered white festoons and vertical trails, with blue *in calmo* rims and with yellow vertical reticella rods; *jars* (both squat vessel-forms with constricted necks and "cups" with short tapered rims) with white reticella decoration and trailing, and with horizontal and marvered feathered yellow trailing; *grape beakers*; and *bowls* with horizontal yellow trailing (and reticella rods?). In addition, a number of further unidentified vessel-types are likely to be present in the sherd assemblage.
- Both the applied bichrome twisted (reticella) cables and the simple trails are mainly made with opaque white or (less frequently) yellow glass. Another typical decorative technique is the application of rims in dark contrast colours (known as *in calmo* decoration). Vessel sherds with a red-flamed or opaque red marbled matrix must also be regarded as characteristic of the Carolingian Period. At Kaupang, red sherds are confined to forms of jar with applied white reticella and trailed decoration. The high frequency of decorated sherds (33.8%) contrasts with the reduction of decoration noted by Lund Feveile (2006:201, fig. 4) in phases E-H/I at the *Posthus* site (phases combined: 24.1%), and suggests that this decrease was not an absolute trend in the early Viking Period.
- *Glassworking* at Kaupang was based on secondary materials. Glass beads were made from imported raw materials: fragments of raw glass, tesserae and semi-manufactured rods. There are no finds of frit, part-fused glass or furnace constructions.
- A small number of window-glass fragments, archaic-looking vessel material and some untypical working waste suggest that scrap glass collected on site or in the hinterland *could* have been used to supplement the raw material available. It has, however, been impossible to demonstrate this chemically hitherto and this is in any case unlikely to have made up a large proportion of the raw material. Some of the glass objects recovered *may* also be related to the production of enamels or inlays, or have been brought to the site as components of metal artefacts that were broken up for recycling.
- On the excavated plots in the MRE trench, beadmaking is concentrated in the earliest settlement period: SP I and SP II:1. Production consisted mainly of monochrome translucent blue, green and opaque white annular beads. At a later point, probably from the late 9th or early 10th century, green beads were manufactured from potassium-rich raw glass.

9.5.1 Glass distribution

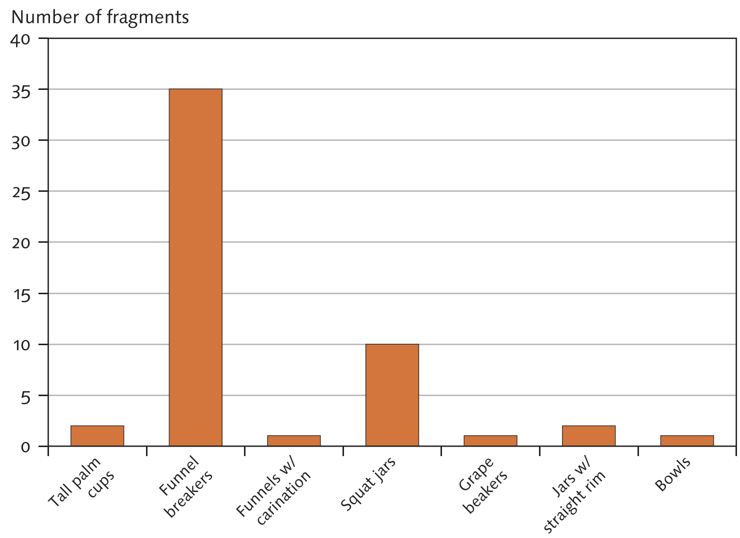
While glass finds are generally rare in Early-medieval Europe outside aristocratic and ecclesiastical settlements (9.1.1), significant vessel assemblages have come to light in specialised and densely settled coastal production and market places (e.g. Hamwic, London, Dorestad, Ribe, Hedeby, Groß Strömkendorf, Åhus and Birka). In Scandinavian and Slavonic areas, coastal trading sites were also centres of beadmaking.

It was demonstrated, above, that the glass vessels from Kaupang are of types found on the western Continent and in Britain. The overall distribution of many of the types suggests that much of the glass came from production areas in the Rhineland along with the ubiquitous Badorf-ware pottery, and reached Scandinavia via the Frisian coast (Both 1999; Sablerolles 1999:238–40 and 242–3; Stiff 2001;

22 The absence of such diagnostic beadworking waste in 8th- to 10th-century Continental and British assemblages is probably a reflex of different costume traditions. Anglo-Scandinavian settlements – influenced by the culture of the incoming population – are an exception in this respect (e.g. Bayley 2000:139–40; Mainman and Rogers 2004:474).

23 It is difficult to know how much weight to place on this distribution because the carinated funnel beaker is a hitherto unrecognised vessel-type that may have gone unrecognised elsewhere (cf., for instance, Hunter and Heyworth 1998, fig. 13, nos. 24/524, 26/824 and 169/1063).

Figure 9.59 *Estimate of the proportions of different vessel-forms at Kaupang, based on the number of identified fragments and recorded Sherd Families from all contexts (Appendix 9.3). The use of estimated minimum numbers emphasises the high proportion of funnel beakers compared to the diagram based on numbers of identified vessel-fragments only (Fig. 9.8). The figure should only be regarded as an estimate of the proportions of different vessel-forms on the site and not as a representation of the actual number of vessels in the live assemblage, which must have been much higher.*



Lund Feveile 2006:235). This inference is reinforced when individual sherds are considered (9.2.3). The decorative festoons and horizontal trails seen on fragments from SF 4 have, for example, their closest parallels in Dorestad. Carinated funnel beakers have as yet only been identified in large quantities north of the Rhine mouth, in Frisia and in southern and eastern Scandinavia (Lund Feveile 2006:fig. 35).[23] The distribution of *in calmo*-decorated vessels has a similar focus, although this picture is less clear cut. For example, double applied rims (Type 6c) have as yet, apart from Kaupang, only been recorded in Hamwic, and may represent the work of an Anglo-Saxon or Neustrian glass manufactory. Almost certainly of Neustrian origin are the funnel beakers with reticella-decorated rims, and objects of potassium-fluxed glass. As of yet, one vessel sherd and a blue tessera made from mixed-alkali glass, along with fragments of potassium-rich raw glass and lead-potassium linen-smoothers, have been identified at Kaupang (Appendix 9.1). Other artefacts recorded at Kaupang are also indicative of contact with Neustria: for example white-ware pottery from the Paris Basin (Pilø, this vol. Ch. 10:294–5) and types of dress accessory such as a hooked clasp (Wamers, this vol. Ch. 4:78–9, 89–90; also Skre, this vol. Ch. 15:402–3, 411-12, Ch. 16:431–34).

That the provenanced glass appears to have come from glass manufactories in the Rhineland or Neustria reveals little, nevertheless, about how it reached Kaupang. Nor does it establish the mechanisms through which this distribution took place:

Vessel form	Tall palm cup /Funnel beaker									Jar							Grape beaker		Bowl	
Applied decoration / Context	Total	Undecorated	Tall palm cup	Arcades	Carination	Trails	Reticella	In calmo	Ribs	Total	Undecorated	Trails	Reticella	Trails + Reticella	In calmo	Ribs	Total	Mould blown	Total	Trails
SPI	2	1	1																	
SPII.1	11	3			3	3		1	1	5	1	1	3							
SPII.2	20	16				4				1				1						
SPIII	1							1												
SPI-III	6	3				1	1	1		7		5	1	1						
Without SP	6	3				3				2		2								
Late-medieval plough-layer	18	15		1				2		9	1	6		2						
Modern ploughsoil	38	26	3			4	1	4		19	5	6	3	2	2	1	1	1	1	1
Without context	1	1																		
Total	103	68	4	1	3	15	2	9	1	43	7	20	7	6	2	1	1	1	1	1

Table 9.22 *Chronological distribution of identified vessel types at Kaupang.*

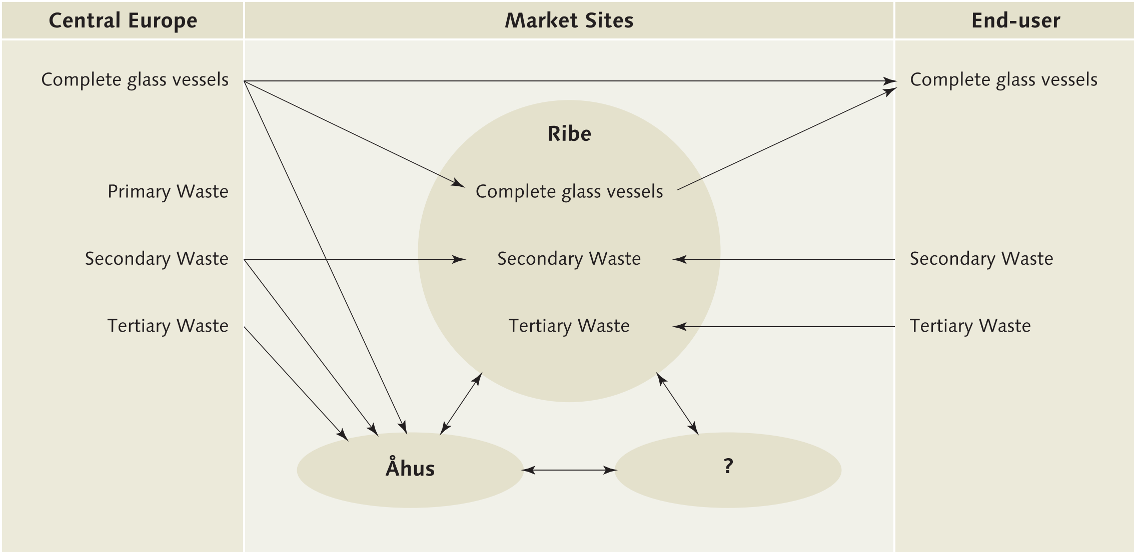


Figure 9.60 *A simplified model of Ribe's involvement in the trade of glass vessels and vessel sherds. Illustration, Elise Naumann after Lund Feveile 2006:fig. 37.*

Figure 9.61 *Profiles of different Early-medieval glass assemblages expressed as percentages of the numbers of identified sherds. Data modulation for sites other than Kaupang is based on Holand 2003a (Borg I) and Stiff 1996 (all other sites).*

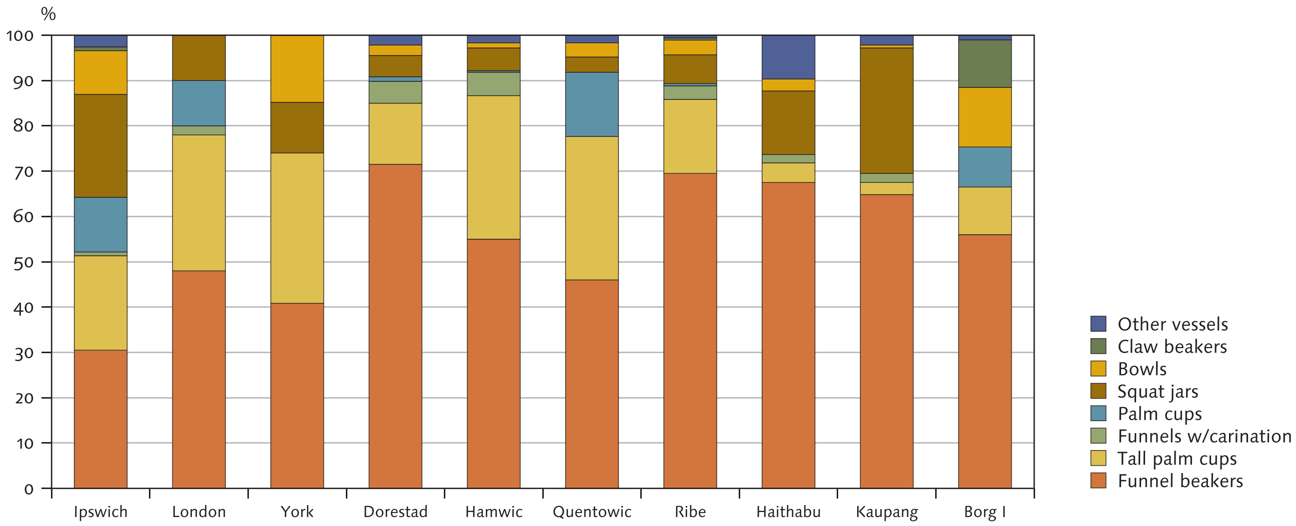
perhaps most likely gift-exchange, small-scale population movement, or trade. A good starting point for a discussion is Lund Feveile's model of the distribution of vessel glass to Ribe (2006:234–40), to which there are many similarities at Kaupang but also some notable differences. In Lund Feveile's model (here Fig. 9.60), Ribe takes up a central position between producers and end-users of the vessel glass, but is also bypassed by some material. In addition, the market town was the recipient of scrap glass broken during transport and by end-users. The cullet could be used as raw material for beadmaking or re-exported to other workshops. Lund Feveile concludes that:

> …there are parallels, particularly in phases C, D and E, between the amounts of glass-vessel sherds, tesserae, glass-bead waste and raw glass, and it is thus primarily in these phases that glass beads were produced. From phase F and onwards the quantity of tesserae, raw glass and glass-bead waste declines distinctly, and at the same time imported beads are introduced in large amounts (Sode and Feveile 2002). The number of glass-vessel sherds does not fall so much. This find-picture can be interpreted as showing that through the whole period, in parallel with the flow of secondary and tertiary waste for use in the bead-maker workshops, there was importation of whole glass vessels (with secondary waste as a consequence). After drastic reduction of the local glass bead production the "remaining quantity" of glass-vessel sherds can reflect the continued importing of glass vessels. *(Lund Feveile 2006:255)*

One important difference, throughout the period of activity at Kaupang, is the stronger emphasis on vessel consumption rather than *glassworking*. This might reflect the difference in date, but also craft organisation. Although beadmaking is recorded, this craft appears to have been relatively limited, and I would suggest that it depended on visiting artisans and the supply of raw materials from other settlements.

Søren Sindbæk (2005:268; see also Sode 2004:88) has argued that large-scale glassworking only took place on a limited number of sites within the southern Scandinavian cultural orbit during the 8th and early 9th centuries (most notably Ribe: Näsman 1979; Gam 1990, 1991; Sode 2004, Åhus: Callmer and Henderson 1991, and Groß Strömkendorf: Pöche 2005). These sites were hubs (Sindbæk refers to them as "nodal points") on the routes travelled by traders and craftsmen, where access to raw materials and other imports was assured. While small variations in the colours and decorative schemes recorded can be related to chronological shifts between the recorded production events, the working techniques and raw materials appear broadly similar.

Johan Callmer (2002:138–41 and 145–50), who has studied beadmaking and other specialised crafts from these sites, has suggested that the extensive similarities are best explained as production carried out by a small group of itinerant artisans working within the same craft tradition. According to Callmer, the beadmakers remained sedentary in one of the larger coastal settlements during winter



months when they laid up glass beads or other goods for sale and stocked up on raw materials. Come market season, however, the artisans would move around to seek out new customers. They would establish themselves on an available plot of land and start production for a time using the raw materials they had brought and possibly some recycled material obtained locally.

The excavated plots in the MRE area at Kaupang suggest that the site was one such occasional stop during the first decades of the 9th century. Bead production appears to have been based almost exclusively on raw materials brought by the artisans themselves: primarily glass rods and raw glass, but also tesserae and possibly some primary waste material from window glazing. Although one cannot conclude that broken vessel glass was never collected and traded (9.4.3), that practice cannot be demonstrated as clearly in Kaupang as in Ribe.

The density of beadworking waste found underlines the fact that the traffic to Kaupang was not particularly frequent, and significantly lower than to Birka or Ribe. Initial figures published by Pedersen and Pilø (2007:fig. 9.1) suggest that the density in comparable sub-samples varies form 17 glass finds per m^3 of excavated soil at Kaupang to 41 finds per m^3 at Birka (1990–1995 excavations) and 58 finds per m^3 at Ribe (the *Posthus* site). The authors suggest (Pedersen and Pilø 2007:183) that this variation is mainly due to the frequency of beadworking, and that the relative circulation of glass beads was more or less similar on all three sites. Although there might be a chronological dimension here, I would suggest that the figures are entirely consistent with a minor role for Kaupang, dependent on glassworkers visiting from other southern Scandinavian sites.

A detailed analysis of the figures, however, reveals that the *importation of vessels* to Kaupang must also have been on a smaller scale than at Ribe and Birka. Because much of the vessel glass from the 8th-century workshop horizons at the *Posthus* site is to be connected with beadmaking (Lund Feveile 2006:240), attempts have been made to study the early 9th-century vessel assemblages in isolation. It is difficult to provide accurate figures for these sub-samples, but an assessment based on stratified late 8th- and 9th-century deposits in Birka (Excavations 1970: Danielsson 1973; Excavations 1990–1995 Phase 1–5: Björn Ambrosiani, pers. comm.) and in Ribe (*Posthus* site Phase F–I: Lund Feveile 2006:appendix 1; Claus Feveile, pers. comm.) suggests that there was a two to three times higher density of vessel glass here than in 9th-century deposits at Kaupang. I will return below (9.5.3) to an estimate of what this might mean in absolute terms.

Comparison with other Early-medieval vessel assemblages reveals that the profile of the Kaupang assemblage is very similar to that of other trading sites (Fig. 9.61). Before one explores the details of the graph it is prudent to recall that there are fundamental problems inherent in the methodology: both its dependency upon identifications made by different scholars, and the uncertain relationship between sherd count and the live assemblage (9.2.4). Here, all the figures, with the exception of Borg I and Kaupang, are based on identifications by Matthew Stiff (1996). It should also be noted that the sites are not strictly contemporary, but cover a range from the late 7th to the 10th century. It can be a challenge to determine which of the observable fluctuations between the sites may reflect chronology and which real differences in consumption. Some of the variations (for instance the proportion of tall palm cups to funnel beakers) may be best explained as chronologically determined.

Despite these caveats, the similarities between the assemblages are striking. Most of the sites are dominated by funnel beakers and tall palm cups.

This holds especially true of assemblages closely linked to or situated within the Frankish realm, and in southern Scandinavia. I have argued elsewhere (Gaut 2007:34–7, see also below) that this special profile must be linked to wine consumption. This commodity is known to have been exported from the major river systems such as the Rhine, the Moselle and the Seine (Annals of Fulda 885; van Es 1990:163–72; Bruand 2002:203–34; Verulst 2002:70–1, with refs.). In her study of first-millennium vessel importation to present-day Norway, Holand (2000) has argued that these were primarily a functional supplement to the range of local vessel-forms. It can be suggested, as a result, that although beverages also were served in cups and bowls of different materials in Ribe and Kaupang, wine glasses were imported because no suitable or fashionable alternatives were available (below, 9.5.3). The adoption of Ipswich- and Tating-ware jugs outside the core area of production can be regarded as a parallel phenomenon (Brown 1997:110; Blinkhorn 1999:10–11).

The Hedeby and Kaupang assemblages also contain a sizeable proportion of jars. Although this might reflect the later chronological emphasis on these sites, it can also point to a slightly different pattern of liquid consumption. An increased proportion of jars is also mirrored on many Anglo-Saxon sites. Likely to be more significant, the York and Ipswich assemblages have a marked presence of larger sized vessels such as bowls and late claw-beakers. If one groups the Borg I assemblage with these sites, one may ask if they represent a Anglian/north-western Scandinavian consumption profile, emphasising *collective* drinking rituals as opposed to the individuality of the smaller, personal drinking glasses found in Continental and early urban communities. On typological grounds it has been suggested that at least one of the glass bowls from Borg originated in north-eastern England or in a glass manufactory that also supplied this area (Holand and Henderson 1992:47).

The similarity between the assemblages from the specialised production and market places is strongly indicative of a common supply of glass, via a similar site or direct from the production areas. The sites were bound together by the North Sea and by access to the distribution system that emerged here during the 8th and 9th centuries. They served both as markets and as control points funnelling goods and people into the reach of royal representatives (Gaut, in prep.).

Most recent works have argued that glass was distributed within this communication network in order to satisfy local or regional demand (below, and 9.5.3; Näsman 1986:82–107, 2000:42–3; Sablerolles 1999:241–3; Stiff 2001; Sindbæk 2005; Gaut 2007:32–4). Hougen (1968:104–5) has proposed instead that most glass and pottery reached Kaupang as personal belongings. There appears to have been a prominent Continental population presence at Kaupang (Gaut 2005b:553; Wamers, this vol. Ch. 4:89–92; Pilø, this vol. Ch. 10:304; Skre, this vol. Ch. 16:406–14; Pedersen, in prep). These people are likely to have been merchants and artisans who visited the site for some time or became part of the permanent population. At least some of them must have brought their own household equipment with them, which could account for some of the glass finds at Kaupang. Taking the quantities of vessels circulating into consideration it would nevertheless be surprising if no direct importation and resale took place (below).

Continental written sources indicate that many town dwellers and traders of this period acted as representatives for large economic institutions, and that much of the 9th-century commodity exchange in the North Sea area, often portrayed in terms of socially neutral buying and selling (e.g. Hodges 2000:79–89), also incorporated administrative transfers between nuclei of estates or prearranged deliveries between major ecclesiastical or secular institutions (Gaut, in prep.). It is not known whether the inhabitants at Kaupang were involved in similar arrangements, but that is not inconceivable. They could be emissaries from economic power houses, ecclesiastical institutions or the secular aristocracy, who also controlled glass production. In addition to glassware transported as personal possessions or trade objects, some vessels may also have been brought to the site to supply emissaries stationed to handle affairs toward the fringes of the known world.

Lund Feveile (2006:234–40; Fig. 9.60) has also argued that the coastal market towns served as gateway communities through which end-users in their hinterland acquired their vessel glass (9.1.1). This assumption is probably based on the economic premiss that vessel glass was an exclusively luxury article, and that the main consumer group was the rural elite. In his analysis of Viking-age trade, Sindbæk (2005:151–4) assumed the same model, but found only a limited uptake of glassware in the hinterland around Ribe, and none in other parts of Jutland. Birka clearly appears to have served as a distribution centre for imports (e.g. pottery and vessel glass) and craft products in the Mälar region (Ambrosiani 1985; Bäck 1997). The situation at Kaupang is less easy to assess because settlement finds or a burial record representative of glass circulation are lacking (9.1.1, Appendix 9.2; Gaut 2007:32–4).

In a short article, Torsten Capelle has approached the question of glass distribution from a logistical viewpoint. In his opinion, the main concern for people transporting vessel glass would have been to minimise breakage of the fragile cargo (Capelle 1988:256–7). The logical solution would be to pack the glass into solid crates and to transport them by sea, as this would minimise bumping and shaking (except in stormy weather). The number of loading and unloading episodes was also likely to have been minimised. This would favour bulk transport to destinations as close as possible to the end-users, instead of the down-the-line trade often advocated in works on the Early-medieval economy (e.g. Näsman 1986:103). Capelle (1988:258) suggests that the large coastal market towns were natural points of unloading, and that the glass was resold there bit by bit. Because the glass vessels would only be unwrapped at this point, any goods damaged in transit (secondary waste in Lund Feveile's terminology) would also be deselected here. Concentrations of vessel sherds are therefore, in Capelle's view, a useful indication of where these loading places were located.

While one would expect transport-damaged goods to have a similar profile to vessel sherds from a consumption site (i.e. sherds that make up complete vessels) it can be assumed that a larger proportion of sherds would be found in areas of unloading and market activities than in living areas. At Kaupang, the vessel-glass finds rather cluster around the house plots, in habitation layers and in zones of domestic refuse. This is a strong indication of local consumption (9.2.6). It is also tempting to point out the absence of glass finds on the beach zone in front of the tenement-plots. This is where unloading and loading of cargos would have taken place and where the glass vessels would presumably have changed hands if they were principally re-exported from the site (cf. Pilø et al. 2003:131–2; Skre and Stylegar 2004:fig. 63). However, relatively small areas have been excavated and only a more extensive and better dated archaeological assemblage from this area can corroborate this argument. The material from Blindheim's excavation is less clear cut in this respect.

Similarly, there is not much positive evidence suggesting the redistribution of vessel glass to Kaupang's hinterland. Apart from the claw-beaker from Mound 1 at Borre, which almost certainly represents a pre-Viking-period heirloom, there is not a single recorded vessel sherd from a Viking-period grave in Vestfold outside Kaupang (cf. Appendix 9.2). Although vessel glass has come to light at the hall site of Huseby close to Kaupang (Gaut 2004; Skre and Stylegar 2004:fig. 75, middle right; Skre 2007f:234–5, fig. 11.11), no other settlements with Viking-period glass finds have been recorded in southern Norway. A very limited number of burial finds are spread evenly along the coastline (Fig. 9.2.a). However, the burial record is not representative of general glass circulation, and there are very few excavated settlements against which to judge its representativity (9.1.1; Näsman 1990:90–4). One must therefore be careful not to put too much weight on the distribution.

Hougen (1968:104) originally suggested that most of the finds along the coast had arrived via non-glass-producing areas in the British Isles, and that this explained the small number of finds (see also Stiff 1996:296; Opedal 1998:68–70). Research by Näsman (1986) and Evison (2000, with refs. to older works) has since substantiated claims that vessel glass was also made in Anglo-Saxon areas. Although there are similarities in the vessel profile from Borg I and some Anglian assemblages (Fig. 9.61), there are few other indications of *direct* commercial contact between the British Isles and Kaupang (Wamers, this vol. Ch. 4:92–7; Skre, this vol. Ch. 16:415–16). It therefore seems unlikely that contact with the British Isles would encourage the transfer of large quantities of glassware to western Scandinavia. At most it is likely to have taken the form of limited gift-exchange (Gaut 2002).

Most of the glass vessels from north-western Europe are likely to originate on the Continent. The imported finds at Borg (especially the glass and pottery) and the perceived association of this site with Ohthere's travelogue have been used to link Borg with Kaupang and North Sea trade (Näsman and Roesdahl 2003:292–4; cf. Gaut 2007:34). Although it is possible that some glass was distributed via Kaupang, especially if that site controlled movement into Danish-influenced territory (Gaut, in prep.), direct importation to Rogaland or the Lindesnes area from the Continent or Britain may also have been feasible (Holand 2000).

9.5.2 Quantification of the Kaupang vessel-glass assemblage

The conclusion that glass vessels were used in the houses at Kaupang, albeit less frequently than at Ribe or Birka, is qualitatively interesting. One would have a better impression of the role glass played in material life, however, were it possible to quantify the live assemblage represented by the sample. Although there can be no absolute answer to how many vessels were circulating in the settlement at Kaupang at any one time, it is possible to make statistical estimates based on *sherd count*, *vessel equivalence* and information about the *excavated* and *total settled area*. Few attempts of this kind have been made for Viking-period glass assemblages (for some examples, see Lund Feveile 2006:207–8, fig. 10), even though similar calculations are habitually made for other bulk finds (Molaug 1989, with refs.). The following discussion offers a practical illustration of how this might be achieved by two alternative methods. The estimates are based on the sub-sample of vessel glass from the MRE, 2000–2002 (C52519) and the methodology is adapted from Molaug (1987:229–33; 1989). The calculation is written out in full to illustrate the method. A cultural historical consideration based on the conclusions follows.

A total of 1100 sq m were originally uncovered (MRE 2000–2001), but only 400 sq m were fully excavated (MRE 2002; Pilø 2007b:153–7). Outside these areas only small volumes of soil were removed. In addition, glass finds were only collected from 35% of the modern ploughsoil covering the site (MRE 2000–2002). *It seems reasonable therefore to suggest that the vessel assemblage represents an average 400 sq m segment of the settlement area – ploughsoil and intact Viking-period deposits included*. It has been estimated that the settled area totalled 54,000 sq m during the Viking Period, while the most densely settled parts, with evidence of plot-division, cover about 20,000 sq m (Pilø 2007c:172–3). This implies that the sample assemblage comes from an area representing 1/135 of the total settled area or around 1/50 of the core settlement with defined plots.

The MRE assemblage consists of 210 vessel sherds. 92 of these sherds derive from 20 Sherd Families. In addition 118 sherds do not belong to an identified Sherd Family. The maximum number of vessels present is therefore 138. This is obviously too high. The majority of the sherds are light green or blue, and it has been pointed out that many of the undecorated fragments are likely to be from single vessles despite the lack of identified sherd links. A better idea can be gained from *the number of rim-fragments*. The MRE sub-sample consists of 31 individual rims. Providing that all the sherds are from complete vessels, a straightforward interpretation would be that the fragments represent 31 vessels. The real figure is probably somewhat higher, around 50, because base and body sherds without matching rims are also present in the assemblage. A conservative estimate indicates that the part of the settlement divided into plots would have produced approximately 10,500 sherds, representing 2,500 individual vessels, if fully excavated. That this extrapolation is valid is indicated by the fact that the number of recovered sherds per vessel (4.2) is close to the recorded average for the designated Sherd Families of more easily identified shapes and decoration in the sample assemblage (9.2.6 note 11).

A more elaborate alternative to rim-count is to use *vessel equivalents* (VE). This involves adding up the proportion of rims preserved from different vessels, where 1.0 VE would equal the presence of rim sherds that together make up 360° (100%) of one vessel circumference (Molaug 1987:232). Cool and Baxter (1996) have recommended the additional inclusion of other vessel parts when calculating the vessel equivalent for glass vessels. With this assemblage, however, this is not practical (9.2.4). The rim sherds are furthermore few and from several different vessel-forms. To maximise the available data I have instead calculated a *hypothetical* rim diameter for a "typical" vessel at Kaupang (using the average diameter of the 22 rims where this variable is measurable), and then how many *estimated vessel equivalents* (EVE) the preserved rim sherds represent. This may appear speculative. However I believe these adjustments can be justified provided it is borne in mind that the result is an estimate and not an absolute quantification of the live assemblage at Kaupang.

The average rim diameter in the sample assemblage is 10.9 cm and the EVE is 1.8. This indicates that each vessel has on average broken into 116–117 sherds (number of sherds/EVE). However, only 4.2 sherds have been collected per identified vessel. If these estimates are correct it suggests that only about 3.6% of the live assemblage represented in the MRE assemblage has been recovered. The 1.8 EVEs are thus likely to represent 50 complete vessels. That the same figure is reached both using estimated vessel equivalents and rim count (above) indicates that the result is realistic. The implication, as noted above, is that an estimated 2,500 vessels were deposited in the core area of the settlement during the period of activity.

One may query whether it is likely that only 3.6% of the original material has been recovered even when all the excavated soil in the MRE area was sieved. A comparison shows that in parts of Early-medieval Southampton only 1.9 sherds per vessel have been collected (Hunter 1980). At Eketorp II the corresponding figure is 2.2 (Näsman 1986), at Borg 7.3 (Holand 2003a), and at Helgö 20 (Lundström 1981). Lund Feveile (2006:207–8 and note 7) has pointed out that the latter estimate must be far too high. Her own estimates for the *Posthus* site suggests that the 1,373 vessel sherds collected represent 283–1,299 vessels (1.1–4.9 sherds per vessel). Were one to base an estimate on the number of rim sherds, like the worked example above from Kaupang, the 214 recovered rims would probably represent close to 350 vessels (3.9 sherds per vessel). Although it is difficult to compare these examples directly, they show that Early-medieval glass assemblages generally contain very small numbers of sherds per vessel. The fact that so little of the live assemblage is recovered appears primarily to reflect the inhabitants' handling of refuse, removing large proportions of their waste material from the settled areas where the vessels were in use (9.2.6). At *Søndre Felt* in medieval Oslo, Molaug (1989:238) has estimated that as little as 10% of the original pottery assemblage was retrieved by archaeologists. A similar situation is encountered in other medieval towns. With glass, there is the added possibility that some of the material was deselected for recycling prior to deposition.

Finally, to estimate how many of the c. 2,500 glass vessels were present in the settlement at any one time one needs to establish both the length of activity on the site and the expected lifetime of the objects. Kaupang was settled in the period c. AD 800–960/80 (Pedersen and Pilø 2007:184–6). One must expect some fluctuations in intensity, with an early seasonal phase and possibly more intermittent activity after 930 (Skre 2008e:200). Using 120 years as a reasonable estimate of permanent settlement, the implication is that on average 20–21 vessels were deposited in the settlement area each year. If the settlement period were shorter, the number of vessels deposited per year would increase. The lifetime of the vessels is more difficult to estimate. Some Scandinavian finds indicate that vessels could be several centuries old when deposited (Aasheim 2007:tab.1; Stjernquist 2004a, 2004b). However these appear to have been cases where the vessels were treated with particular reverence and skilfully mended when broken. The handling of the glass vessels at Kaupang suggests the opposite: that they were treated as utilitarian goods and never repaired. Molaug (1989:236–7) proposes that the ceramic tableware from Søndre Felt, Oslo, had an average lifetime of 5–10 years. A similar situation might be imagined for the Kaupang glass tableware. This would suggest that at any one time 100–210 glass vessels were in use in the settlement, although the figure is likely to have fluctuated relative to the activity on the site.

Estimates based on the number of burials suggest a permanent population of between 200 and 500 persons at Kaupang, with seasonal peaks of up to 1,000 inhabitants (Stylegar 2007:85–6). I regard 350 as a reasonable estimate of the average, permanent adult population that is most likely to have used glass vessels. If the glass vessels were evenly distributed, between one in four and one in two of the inhabitants owned their own glass. This is unlikely, however. It is more probable that multiple glasses belonged together in serving sets. Spatial analysis reveals distinct differences between the excavated buildings and plots in respect of the presence of glass (9.2.5 and 9.2.6, Fig. 9.40) and suggests that some households owned sets of several glasses while others had none – at least none that have left traces in the material record.

9.5.3 The social consumption of glass vessels

Although no accurate figures can be provided, the estimates above have revealed a society where glass vessels were present in surprisingly large numbers and their use must have been widespread. Considering the general scarcity of glass finds in Scandinavia, there are reasons to wonder why glass was so prolific at Kaupang in particular. Another point to keep in mind is the disparity in the presence of glass between the excavated plots (9.2.6). It is not possible to determine whether such variations reflect cultural, social or economic differences between households, but one can at least start to address this question by exploring the social context in which glass vessels are likely to have been used. It will be argued that vessel glass was introduced by Continental traders and artisans visiting Kaupang, but that the local demand for glassware grew as a feature of the material culture associated with an emerging cosmopolitan class of artisans and merchants in the early market towns around the North Sea.

The use of different Viking-period vessels-forms for different purposes was briefly noted above (9.2.3). While glass bowls and jars/cups can be related to drinking ceremonies that have a root in domestic culture (and thus only served as a new medium for such consumption), funnel beakers and tall palm cups can be more firmly associated with the introduction of Continental table etiquette. As the standard Continental drinking glass of the period, funnel beakers are specifically associated with the consumption of wine (e.g. Steinhausen 1939; Hagen 1994:230; Gai 1999:215–16; Sablerolles 1999:242–3). A central element in this case is the conceptual link between glass beakers and ceramic vessels, particularly Tating-ware jugs, established by Detlev Ellmers (1965; Gaut 2007:35, with refs.). In Early-medieval burials and pictorial representations throughout north-western Europe, jugs and funnel beakers appear together as parts of a set of tableware for drinking wine (as opposed to bowls and other containers associated with the consumption of mead or ale). Because funnel beakers and tall palm cups are relatively small,[24] and the wine is likely to have been served blended and sweetened as a "long drink" (Hagen 1994:217–30), the glasses would require frequent refilling from a jug. Wear-marks suggest that the vessels were turned upside down when emptied (Stiff 1996:104; Gai 1999:214–6).

Several authors have noted the congruent distribution of glassware and Tating-ware jugs (e.g. Müller-Wille 1985:figs. 9–11; Gabriel 1988:fig. 12; Steuer 1999:411), although their emphasis on reticella-decorated glass is arguably of limited significance since bowls, jars and funnel beakers could all be decorated in this way. More significant is the concentration of finds at market sites and a limited number of elite settlements. These are places one may rea-

24 Siegmund (1998:172–5, fig. 80) has calculated the volume of a number of tall palm cups from the Lower Rhine area. The largest group of vessels (N=6) has a capacity of 2.4–3.6 dl. Funnel beakers are likely to have a comparable volume (0.3–0.4 l) underlining the typological and functional relationship between these vessel-forms (cf above, 2.1). Although the size of many glass jars and cups must have been similar, they are likely to have served a different function (above, 2.3).

sonably expect to be influenced by Carolingian drinking culture and where wine would be available (*Rígsþula*, st. 32; Hagen 1994:220–30). Wine is also likely to have been distributed to Kaupang through trade or administrative supplies (Gaut 2007:35–6).

The profile of the pottery assemblage at Kaupang provides a helpful guidance for an analysis of the vessel glass. In her analysis of the pottery from Blindheim's settlement excavations, Hougen (1993:30) noted the high percentage of fine ceramic tableware. Approximately 20% of the sherds could securely be assigned to this category. This figure is significantly higher than in Dorestad, for example. Most of these vessels are jugs and pots with spouts for pouring. Hougen has suggested that the finds should be associated with drinking wine. The distribution of jugs and other tableware is also spatially distinct from that of imported amphorae, with jugs and pots concentrated more upon the excavated houses,[25] and in burials, than other ceramic containers (Hougen 1993:46–8). A similar pattern is also observed for vessel glass from Blindheim's trenches (Fig. 9.39). Particularly illuminating from the point of view of the present study is the ceramic jug that was found together with fragments of several glass vessels in the "House I" area of Blindheim's excavation (Blindheim 1974:92).

In the case of Skre's excavation, it has been possible to establish that the activity horizons that contain vessel glass often also contain sherds from Tating-ware jugs or Badorf-ware pottery (see also Pilø, this vol. Ch. 10:286–92). This suggests that their use was interrelated and perhaps connected to the serving of wine at the table. It was, for example, noted above (9.2.5) that the only plot (2A) where hard-fired pottery (Badorf and Mayen Wares) was deposited during SP I also produced finds of vessel glass. This may reflect the use of glass and ceramic tableware on this plot in this period.

Tating Ware and large quantities of Badorf Ware, however, are only present from SP II, contemporary with the increased use of drinking glasses. With regard to spatial distribution, sherds of black-burnished Tating Ware are predominantly associated with refuse layers on Plots 1A and 4B. Many of these contexts also contain fragments of vessel glass. The concentration of glass on Plots 3A and 3B in the latter part of SP II is mirrored by a separate group of greyish-brown sherds with applied tin foil (Pilø, this vol. Ch. 10:Fig. 10.13). Other Tating-ware jugs that were used may, of course, not have been broken and disposed of on the plot; or might have been replaced by other pouring vessels (as also noted by Hougen 1993). Amongst the finds that can be associated with the glass fragments from these buildings is a spout of a Badorf-ware pitcher (Dorestad W IIC class y: cf. van Es and Verwers 1980:74–6, fig. 2. Fragments of similar pitchers have also come to light in other parts the site. Fragments of a Zelzate-like costrel from the Vorgebirge region (Pilø, this vol. Ch. 10:Fig. 10.14),[26] and a similar fragment of Continental white ware (Pilø, this vol. Ch. 10:294), most probably represent containers for fine beverages such as wine (van Es and Verwers 1975:141–5; Hodges 1981:63).

Although much of the other imported Continental pottery at Kaupang was subsequently used for cooking (Pilø, this vol. Ch. 10:304), I agree with Hougen that much of the fine Continetal *tableware* is likely to be related to the serving of wine. Transport of wine may also have been the primary function of some of the wooden barrels lining wells on the site and the many fragments of *Reliefband* amphorae (Gaut 2007:35; cf. Pilø 2007d:218–20).

In the past, Tating Ware and vessel glass has almost exclusively been related to high-end consumption and the acquisition of social status. I would, however, hesitate to describe the consumption seen at Kaupang and other comparable specialised production and market sites in these terms. There are two parts to this argument. Firstly, the context of the finds is not elite burial or a magnate farm but modest urban surroundings. There is every reason to believe that those present on the trading site were primarily craftsmen or merchants, not the social elite. Some of these were undoubtedly independent entrepreneurs exploiting the chance of making an economic profit, but what is embodied in the archaeology of the site is not conspicuous consumption but a material culture adjusted to a mass market. Based on the morphology of the funnel beakers and the ubiquitous presence of glass beakers and imported pottery at Kaupang, it can be suggested that these objects had become alienable commodities within the orbit of North Sea trade during the 8th and 9th centuries and were regarded as practical utensils (Gaut 2007:34–6). The high number of identified drinking glasses and ceramic pitchers might be explained by a need to fill a functional gap in domestic tableware when wine-drinking was introduced (cf. Brown 1997:110), and it may be argued that it was this rather than any associated elite connotations that triggered the use of this tableware at Kaupang.

Secondly, it is clear that the availability of wine alone cannot explain why foreign table etiquettes were adopted at Kaupang. That neither wheel-thrown pottery nor vessel glass were found in the

25 Pilø's reassessment of Blindheim's excavation indicates that the structures concerned also comprise the immediate surroundings of buildings rather than strictly the houses alone (Pilø 2007a, 2007d).

26 One of these can be associated with the sand-filled passage between Plots 1A and 2A in SP II:1 (Pilø, this vol. Ch. 10:304)

rich 9th-century burial at Oseberg, less than 40 km from Kaupang, indicates that these objects should not automatically be regarded as high status objects craved by everyone. Ceramic and glass tableware must therefore have filled a function that made them specifically attractive to the inhabitants at Kaupang. The phenomenon of *kaupskál* and the role played by feasting in forging social bonds in urban communities will be explored here.

During the Middle Ages, contracts could be sealed with a formal drink, a so-called *kaupskál*. Høie (2006:78–97) specifically relates the distribution of drinking glasses close to houses at the waterfront in Bergen to this phenomenon. Although these front buildings primarily served as store rooms, living quarters on the first floor, overseeing the harbour, are documented as having been used for trade negotiations (Helle 1982:217–18). Pointing to the correlation between large glass assemblages and Viking-period trading settlements, Sindbæk (2005:157–60) has suggested that the glass vessels could be regarded as "tools of trade". Drinking together could promote mutual trust and level any social or cultural differences between prospective trade partners *before* negotiations commenced: consider the emphasis placed on *trust* in later works on trade (e.g. Gustin 2004:174–86; Kilger 2008b:299, 320–1). This is an interesting proposition, and it is not unlikely that contract negotiations were started or sealed with the serving of wine in fine glasses. However, this seems a rather narrow interpretation considering the quantities of glassware that circulated in the settlement. *Kaupskál* is anyway only likely to have been toasted over large contract agreements, while most smaller transactions were presumably carried out quite briskly at open booths.

While the first glass vessels are likely to have been brought to Kaupang by immigrants or visitors from glass-using areas, the custom of drinking from glasses appears to have been taken up by itinerant and domestic artisans and traders who wished to interact with them on an equal footing. From sociological and ethnographical studies, it is known that the absorption of selected cultural features, in this case Continental table etiquette, can facilitate interaction across cultural boundaries (e.g. Olsen 1988; Roslund 2007:128–54 and 469–530). This is likely to have been exploited in the cosmopolitan market towns of the period where people from different regions met regularly. Drawing on work by Callmer (2002), it can be suggested that glass and ceramic tableware must have served to forge social unity between the itinerant traders and craftsmen settled here, and that it became part of a new material reality created to distinguish the population from the hinterland.

Max Weber (1966:91–120) had suggested that the commensality of medieval towns contributed to the development of fraternities and civic organisations that superseded the kin or social patronage in importance within urban populations. Bjørn Qviller (1996:31–45) has emphasised the role that feasting and drinking played in the constitution of these fraternities. He regards these events as *sambyrðingslög*, a meeting of equals around the table where they eat and drink what they had all contributed to. It is also, however, possible to see these events as expressions of the older Celtic/Germanic tradition of forging imaginary kinships through shared drink (Enwright 1996). These communities served as the basis for *handelsfélag* ("trading societies") and guilds, recognised in written sources from the 11th century, which were actual table fellowships as well as economic and social organisations. Wamers (1991a:150–2) explicitly links the diffusion of drinking sets such as the Fejø assemblage through Scandinavian society to fraternities of this kind.

Many social phenomena described by Weber can only have existed in an embryonic state during the Viking Age. There are, for example, clear indications in early Anglo-Saxon law-codes that the security and social standing of foreign merchants in the late 7th century were still related to those of wealthy patrons or others willing to adopt them into their household (e.g. Hlothhere and Eadric's Laws §15 and Ine's Law §23 in Attenborough 1922). Weber himself points to the intimate relationship between rural lords and the "ownership" of and taxation regime in early urban communities. This situation is also reflected in Carolingian, Lombard and Anglo-Saxon diplomas (Gaut, in prep.). Strong economic and social ties continued to exist between the activity on urban plots and the rural estate economy throughout the Early Middle Ages. On the other hand, the seeds of several new developments, like the transformation of tenurial bonds into purely economic relationships and the creation of a socially independent group of artisans and traders, can be traced at the same time. It is due to this development that the table fellowships, bringing together people from different cultural, social, and ethnic backgrounds in the embryonic market towns, took on a wider significance than that of merely eating and drinking, and contributed to the formation of a new social identity.

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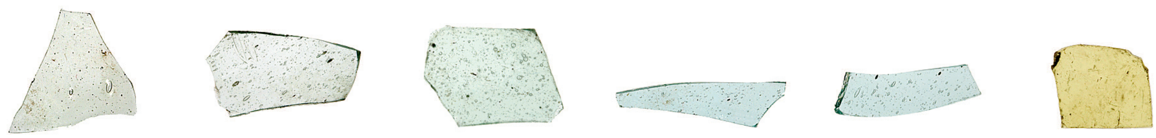
I am also grateful to the participants of the Kaupang Excavation Project and an unknown referee for useful comments to previous drafts of this text. Julie Øhren Askjem, Elise Neumann and Steinar Kristensen (KHM) have patiently assisted with illustrations and in other technical matters.

Figure 9.62 *Various glass from Kaupang.*

a–j: *Vessel glass (C52516/1769, C52516/3162, C52519/10660, C52519/18682, C52519/18573, C52519/12173, C52516/3552, C52519/10839, C52519/27356, C52519/24204).*
k–l: *Vessel glass, corroded (C52519/38391, C52519/40305).*
m–p: *Vessel glass, heat exposed (C52516/3616, C52519/23450, C52519/19473, C52519/18683).*
q–r: *Vessel glass, (various decorations) mould blown (C52519/20255, C52519/38381).*
s–t: *Vessel glass, trailed (body colour) (C52519/16470, C52519/11019).*
u–at: *Vessel glass, trailed (opaque colours) (C52519/9460, C52517/1566, C52516/1303, C52516/4193, C52519/38382, C52519/40399, C52519/20923, C52516/3712, C52519/10756, C52264/932, C52519/12378 C52519/24587 C52519/29002, C52519/29001, C52516/4192, C52519/16590, C52517/881, C52264/487, C52519/17193, C52264/588, C52264/581, C52160/256, C52516/2632, C52519/9659, C52519/10057+C52519/11646, C52519/19666+C 52519/26087+C52519/24799).*
au–ba: *Vessel glass, in calmo (C52264/723, C52519/9886, C52264/816, C52264/976, C52519/21704, C52516/2705+C52519/22663, C52519/9441).*
bb–bi: *Vessel glass, reticella (C52167/1962, C52167/1965, C52264/483, C52517/2136, C52519/10385, C52516/5777, C52517/1701, C5251 6/4537+C52516/4191+C52519/11253).*
bj–bn: *Vessel glass, red colour (C52519/20254+C 52519/9997+C52519/21703+C52519/12257, C52519/19484, C52519/9966+C52519/24047, C52519/10068, C52519/11999).*
bo–bw: *Vessel glass, rim sherds (C52519/9925, C52519/29003, C52264/921, C52519/38369, C52519/10121, C52519/10210, C52519/22789, C52519/10288, C52519/21045).*
bx–by: *Vessel glass, base sherds (C52519/12478, C52519/17215).*
bz–ce: *Window glass (C52519/12099, C52519/19988, C52519/11358, C52519/10934, C52519/25135, C52516/4148).*
cf–ci: *Inlays (C52519/10545, C52519/20461, C52519/7070, C52519/27578).*
cj: *Gaming piece (C52516/1770).*
ck–cm: *Linnen smoothers (C52519/10388, C52519/9817, C52519/40723).*
cn-co: *Tesserae (C52519/11780, C52579/28306).*

Photo, Eirik Irgens Johnsen, KHM.



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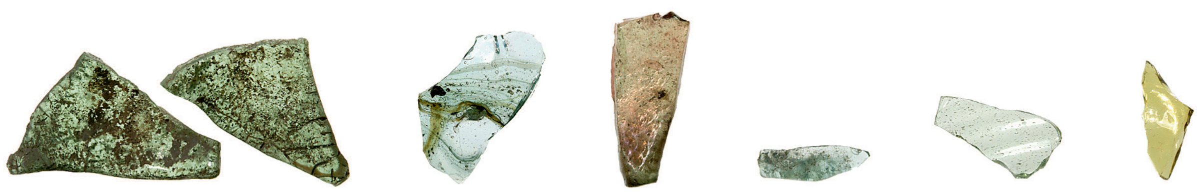

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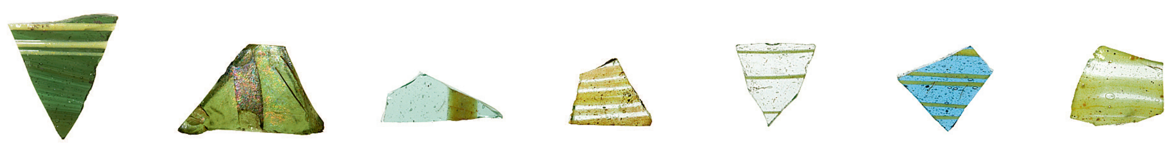

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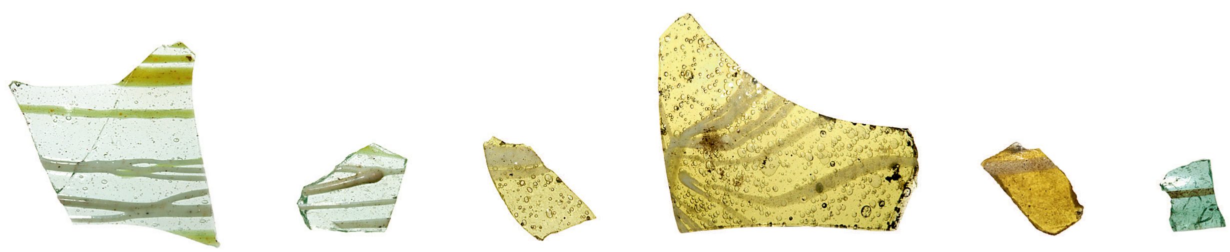

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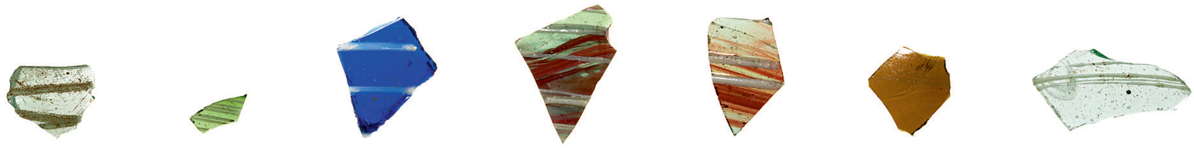

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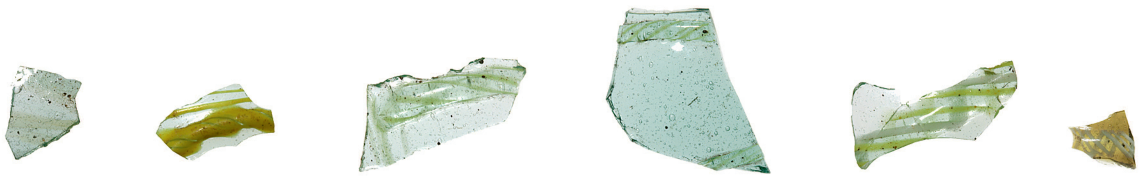

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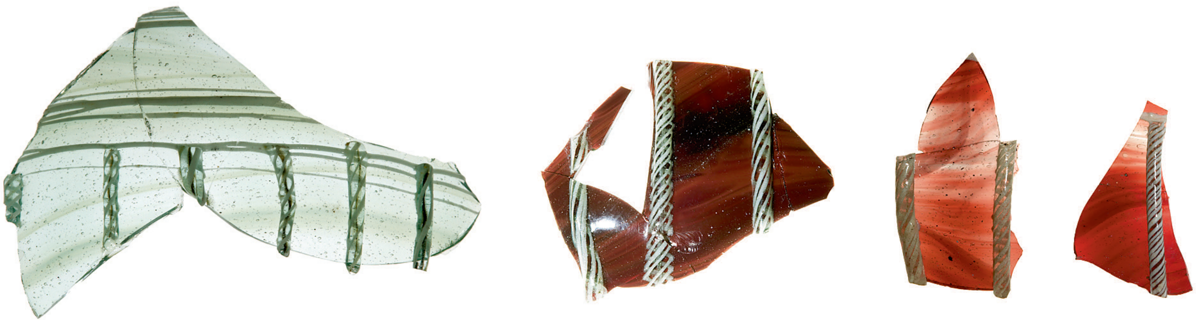

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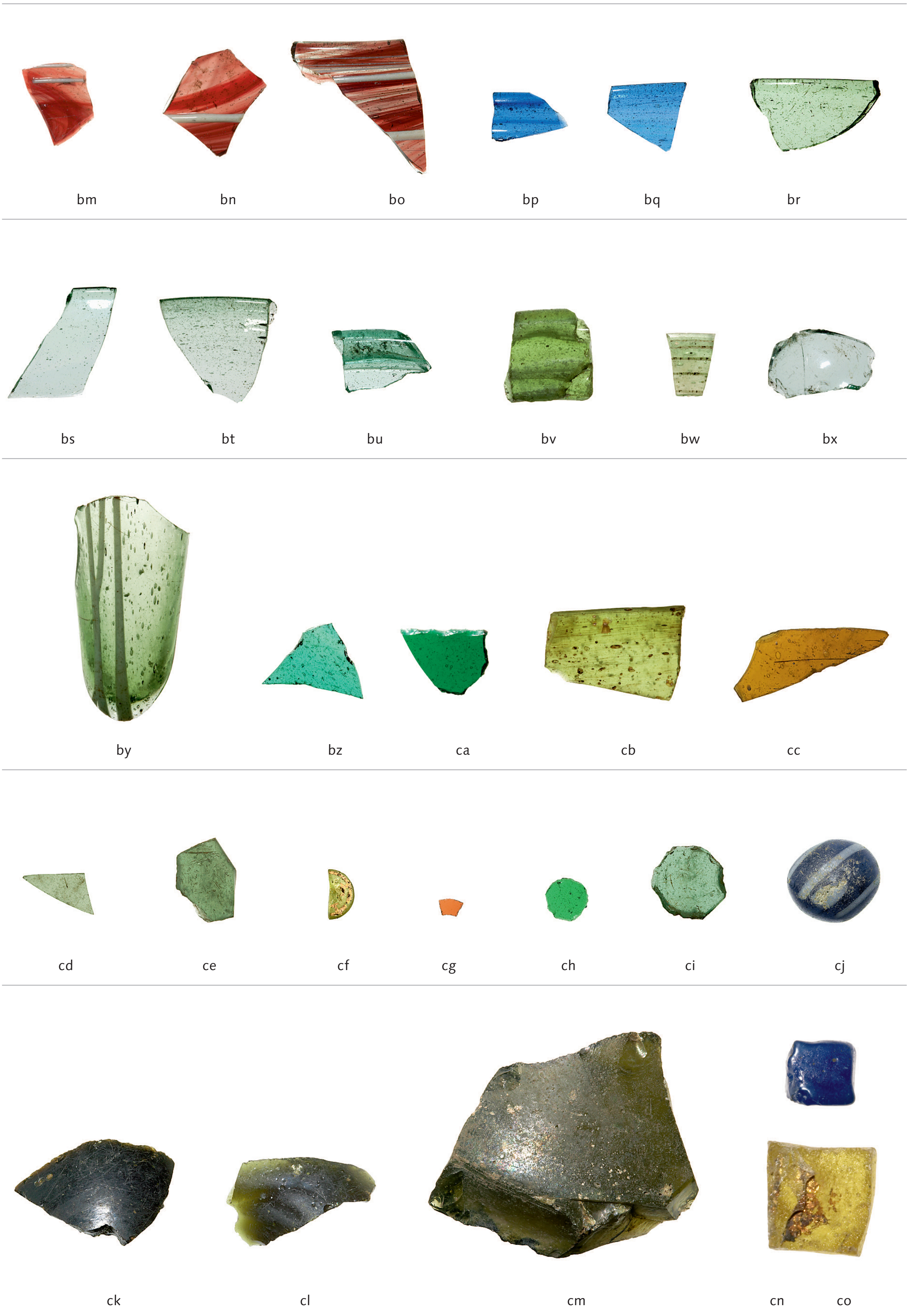
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Appendix 9.1 Compositional analyses

Bjarne Gaut with Julian Henderson

The composition of the Kaupang glass has been investigated by means of *electron probe microanalysis* (EPMA) and *energy dispersive x-ray fluorescence* (EDX). In all, 112 objects representative of the range of artefacts and colours on the site were sampled. Emphasis was placed on providing a statistical basis for the identification and discussion of the different glass types that circulated in southern Scandinavia during the early Viking Age, in order to illuminate any compositional differences between vessel glass and the beadworking materials, and between the stratified early 9th-century material and finds from the later ploughsoils. The EPMA analyses were carried out by Professor Julian Henderson at the University of Nottingham and the EDX analysis by Dr David Dungworth of English Heritage.

In addition, a small number of specifically targeted isotope analyses have been carried out. *Laser ablated inductively coupled mass spectrometry* (LA-ICP-MS) was used to characterise the lead in three samples of lead-potassium glass. *Thermal ion mass spectrometry* (TIMS) was used to measure the isotopes of neodymium and strontium in order to characterise the silica and alkali sources in selected samples.

The analytical data from the EPMA and EDX analyses are presented below (Tabs. 9.23–4). It is beyond the scope of this appendix to discuss the results in full. Some conclusions are drawn with regard to the origin and distribution of the glass. For a more detailed discussion, and a description of the methodology and sampling strategy, readers are referred to archive reports (Gaut 2006; Dungworth et al. 2007; Guerrot 2007) and work in progress by Gaut and others (in prep.).

Table 9.23 *EPMA samples from Kaupang.*

Inventory no.	C52516/643	C52519/16675	C52516/5491	C52516/2248	C52519/25655	C52519/12094	C52519/27397	C52519/9621	C52519/9817	C52519/22773	C52516/2267	C52519/20700	C52516/4186	C52516/3377	C52519/12098	C52519/11780	C52519/ 19635	C52519/16586	C52519/16577	C52519/9931
Sample	KAU 1	KAU 2	KAU 3	KAU 4	KAU 5	KAU 6	KAU 7	KAU 8	KAU 9	KAU 10	KAU 11	KAU 12	KAU 13	KAU 15	KAU 16	KAU 17	KAU 18	KAU 19	KAU 20	KAU 21
Artefact	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass	Tesserae	Tesserae	Tesserae	Tesserae	Tesserae	Tesserae	Tesserae
Colour	Cob.	p.Bl.	Cob.	p.Gr.	p.Y-Gr.	Aq.	dk.Ol-Gr.	dk.Ol-Gr.	dk.Ol-Gr.	p.Bl.	p.Bl.	p.Bl.	Aq.	o.Y-Gr.	o.pl.Gr.	(o) Cob.	p.Bl.	o.Trq.	o.Y-Gr.	Cob.
Context	Medieval	e.9th C	e.9th C	Medieval	e.9th C	Medieval	e.9th C	e.9th C	e.9th C	e.9th C	Medieval	e.9th C	Modern	e.9th C	e.9th C	Modern	Medieval	Medieval	e.9th C	e.9th C
Group	Natron	Natron	Natron	HLLA	High-potassium	High-potassium	Lead-potassium	Lead-potassium	Lead-potassium	Natron	Natron	Natron	Modern	Natron	Natron	Natron	Natron	Natron	Natron	Mixed-alkali
Na_2O	17.3	18.8	18.6	2.1	2.8	1.9	1.7	1.7	1.5	18.8	18.6	19.0	13.5	18.2	18.1	16.1	18.9	21.2	18.0	10.2
K_2O	1.9	0.7	0.8	3.0	7.6	10.2	4.0	3.9	3.6	0.8	0.7	0.8	0.2	0.6	0.6	0.6	0.7	0.9	0.7	12.2
CaO	6.1	6.6	6.7	26.2	15.7	13.3	13.6	13.6	14.5	6.7	6.6	6.7	8.4	5.6	6.6	7.9	6.6	6.9	5.9	6.5
SiO_2	66.3	66.4	66.0	57.8	58.4	61.1	43.7	43.3	42.7	66.9	67.5	65.3	74.1	63.5	67.3	67.5	66.5	60.4	64.9	65.9
MgO	4.3	0.8	0.9	3.3	4.7	5.7	2.4	2.5	2.5	0.9	0.8	1.0	0.2	0.8	0.6	0.7	1.0	2.2	0.7	0.6
MnO	0.3	0.6	0.5	0.1	0.8	0.8	0.2	0.2	0.3	0.6	0.5	0.6	0.1	0.3	0.6	0.6	0.4	1.2	0.4	0.4
SO_3	0.2	0.3	0.3	0.5	0.2	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.2	0.2
BaO	0.0	0.0	0.0	0.0	0.2	0.2	1.7	1.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al_2O_3	1.9	2.4	2.5	2.7	4.3	2.8	7.6	7.5	6.1	2.5	2.5	2.4	1.3	2.3	2.4	2.5	2.4	2.6	2.2	2.2
FeO	0.9	0.9	0.9	1.4	1.9	1.1	2.1	2.1	2.0	1.0	0.8	1.1	0.5	0.6	0.4	0.6	0.9	1.2	0.9	0.5
SnO_2	n	n	n	n	n	n	n	n	n	n	n	n	n	0.0	n	n	n	0.1	n	n
TiO_2	0.1	0.1	0.1	0.2	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
CoO	0.1	0.1	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
SrO	0.0	0.0	0.0	0.1	0.0	0.0	n	0.0	n	0.0	0.1	0.0	n	0.0	0.1	0.0	0.0	0.1	0.0	0.0
ZrO_2	0.0	n	n	0.0	0.0	0.1	0.0	n	n	0.0	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0
Cr_2O_3	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n	0.0	n	0.0	0.0	n	0.0	0.0	n
CuO	0.1	0.3	0.3	n	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.6	0.0	1.6	0.4	0.1	0.2	2.3	1.6	0.0
Sb_2O_5	0.3	0.9	1.0	0.1	0.3	0.4	0.7	0.7	0.5	1.0	0.9	0.9	0.0	1.3	2.7	1.8	1.4	0.3	0.7	0.8
P_2O_5	0.2	0.1	0.1	1.8	2.0	1.7	1.3	1.4	2.0	0.1	0.1	0.2	0.0	0.1	0.1	0.2	0.1	0.5	0.1	0.1
ZnO	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PbO	n	0.1	0.1	n	n	n	18.2	18.5	21.0	0.1	0.1	0.4	n	4.1	n	n	0.0	0.1	3.3	0.3
V_2O_3	0.0	0.0	n	n	n	0.0	n	0.0	n	0.0	n	0.0	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0
NiO																				
As_2O_5																				
Cl																				
Total	100.3	99.4	98.9	99.3	99.3	99.6	97.7	97.5	97.4	100.0	100.1	99.6	98.8	99.5	100.3	99.0	99.6	100.4	99.8	100.1

Inventory no.	C52519/29024	C52519/23596	C52519/18585	C52519/18580	C52519/29046	C52519/27224	C52519/22410	C52519/19292	C52519/28681	C52519/28681	C52519/28673	C52519/23642	C52519/22799	C52519/9661	C52519/9661	C52519/10288	C52519/20255	C52519/9660	C52519/29003	C52519/9441
Sample	KAU 22	KAU 23*	KAU 24	KAU 25	KAU 26	KAU 27	KAU 28	KAU 29	KAU 30	KAU 31	KAU 32	KAU 33	KAU 34	KAU 35	KAU 35a	KAU 36	KAU 37	KAU 38	KAU 39	KAU 40
Artefact	Rod	Rod	Rod	Rod	Rod	Rod	Rod	Rod	Bead	Bead	Bead	Rod	Bead	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel
Colour	Cob.	Cob.	o.Wh.	o.Wh.	o.pl.Gr.	o.pl.Gr.	o.Y.	o.Red	o.Wh.	o.Wh.	o.v.pl.Gr.	Cob.	Cob.	Aq.	Cob.	Ol.Y-Gr.	pl.Gr.	Aq.	Cob.	pl.Gr.
Context	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	Medieval	Modern	e.9th C
Group	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron
Na2O	18.2	19.9	19.5	18.5	18.4	17.9	15.5	17.8	18.5	18.5	17.2	18.0	18.3	17.9	17.6	18.2	19.7	18.8	17.6	19.2
K2O	0.8	0.5	0.6	0.6	0.7	0.8	0.7	0.7	0.5	0.7	0.8	1.2	0.8	1.5	1.9	0.9	0.8	0.7	1.5	1.0
CaO	6.7	6.4	6.4	6.2	6.2	6.8	5.3	6.6	6.6	6.5	6.5	6.6	6.6	7.1	7.8	6.7	6.3	6.7	6.7	6.6
SiO2	66.8	66.9	64.8	61.2	63.8	66.3	53.8	65.5	65.9	64.2	62.9	66.2	66.7	66.4	63.4	62.7	65.9	66.8	65.4	66.4
MgO	0.8	0.8	1.0	0.9	0.9	0.8	0.8	0.8	1.7	0.9	0.8	0.9	0.9	1.5	2.8	1.3	1.0	0.8	2.3	0.8
MnO	0.6	0.3	0.6	0.5	0.5	0.4	0.5	0.5	0.5	0.7	0.5	0.5	0.6	0.7	1.0	0.5	1.0	0.7	0.6	0.7
SO3	0.3	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.2	0.3	0.2
BaO	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1
Al2O3	2.4	2.2	2.2	2.2	2.4	2.5	2.1	2.4	2.1	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.4	2.4	2.4	2.3
FeO	0.9	1.0	0.7	0.7	0.8	0.6	0.8	2.7	0.5	0.7	0.8	0.9	0.9	0.9	0.9	1.0	0.8	0.7	1.0	0.6
SnO2	n	n	0.8	5.7	0.1	0.1	2.5	0.0	n	2.2	3.2	n	n	n	n	n	n	n	n	n
TiO2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1
CoO	0.0	0.0	0.0	0.0	n	0.0	0.0	n	0.0	0.0	n	0.0	0.0	0.0	0.0	n	0.0	0.0	0.1	n
SrO	0.0	0.1	0.0	0.0	0.0	0.0	n	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
ZrO2	0.0	n	0.0	0.0	0.0	n	n	0.0	n	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n	0.0
Cr2O3	0.0	n	0.0	0.0	0.0	0.0	n	0.0	n	0.0	0.0	0.0	0.0	0.0	n	n	0.0	0.0	0.0	0.0
CuO	0.4	0.3	0.1	0.4	1.0	0.1	0.1	1.0	0.0	0.1	0.1	0.3	0.4	0.2	0.2	1.4	0.0	0.1	0.2	0.0
Sb2O5	1.0	1.0	0.4	0.8	0.6	0.3	0.2	0.2	1.9	0.3	0.3	1.0	1.0	0.5	0.4	0.9	0.2	0.3	0.6	0.2
P2O5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1
ZnO	0.0	n	n	n	0.0	0.0	0.0	0.0	n	n	0.0	0.0	0.0	0.0	0.1	0.0	n	0.0	0.1	0.0
PbO	0.2	0.2	0.8	2.1	3.6	2.5	16.5	0.2	n	1.1	2.7	0.1	0.2	0.1	n	2.4	0.0	0.1	0.1	n
V2O3	0.0	n	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NiO																				
As2O5																				
Cl																				
Total	99.4	99.9	98.4	100.4	99.7	99.4	99.4	99.1	99.0	98.9	98.6	98.7	99.2	99.6	99.1	99.0	98.8	98.6	99.1	98.4

Inventory no.	C52519/9441	C52519/20254	C52519/20254	C52519/10210	C52519/22789	C52519/9460	C52519/9460	C52519/19473	C52519/19988	C52519/26494	C52519/26473	C52519/26485	C52519/22787	C52519/23858	C52519/26511	C52519/22770	C52519/29049	C52519/27572	C52516/1681	C52519/25499
Sample	KAU 41	KAU 42	KAU 43*	KAU 44*	KAU 45	KAU 46	KAU 47	KAU 48	KAU 49	KAU 50	KAU 51	KAU 52	KAU 53	KAU 54*	KAU 55	KAU 56	KAU 57	KAU 58	KAU 59	KAU 60
Artefact	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Window	Bead	Bead	Bead	Bead	Bead	Bead	Raw glass	Raw glass	Raw glass	Raw glass	Raw glass
Colour	dk.Trq.	o.Red	pl.Gr.	pl.Gr.	pl.Gr.	pl.Trq.	o.Red	Clr.less	Em-Gr.	o.Trq.	Cob.	Cob.	o.Trq.	Ol.Y-Gr.	o.Wh.	Cob.	pl.Bl.	pl.Bl.	Aq.	pl.Gr.
Context	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C
Group	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	PAG	Natron	Natron	Natron	High-potassium	Natron	Natron	Natron	Natron	Natron	High-potassium
Na2O	18.1	19.1	19.3	18.3	18.1	19.3	19.1	18.8	19.4	17.1	18.5	18.4	19.0	2.0	19.8	16.2	17.3	16.5	13.9	1.8
K2O	1.6	0.8	0.8	1.0	1.0	0.7	1.0	0.9	0.7	3.2	0.8	0.8	0.7	11.0	0.6	0.8	0.6	0.7	0.4	12.6
CaO	6.6	6.6	6.6	7.2	8.7	6.5	6.7	7.2	6.2	6.7	6.9	6.8	6.2	16.5	6.6	6.6	6.2	6.3	9.5	12.5
SiO2	65.0	67.4	67.7	68.1	66.7	66.7	66.3	67.7	64.3	63.5	68.3	67.8	63.5	58.7	64.2	72.8	73.2	72.2	72.2	58.8
MgO	0.9	0.9	0.9	1.0	1.7	0.9	0.9	0.9	1.0	5.0	0.8	0.8	0.9	5.4	1.0	0.7	0.8	0.9	0.6	6.1
MnO	0.7	0.8	0.8	0.6	1.1	0.5	0.6	0.6	0.6	0.3	0.5	0.5	0.7	0.8	0.7	0.5	0.5	0.6	0.3	0.7
SO3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.1	0.0
BaO	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	n	0.1
Al2O3	2.4	2.5	2.4	2.5	2.3	2.4	2.5	2.5	2.3	1.8	2.4	2.5	2.3	3.0	2.3	2.4	2.2	2.2	2.3	1.7
FeO	0.7	1.8	1.6	0.9	1.0	0.7	1.6	0.8	0.9	0.5	1.0	0.9	0.6	1.2	0.8	0.9	0.9	0.9	0.9	0.6
SnO2	n	n	n	n	n	0.1	n	n	0.2	n	n	n	0.4	n	3.8	n	n	n	n	n
TiO2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.3	0.1
CoO	0.0	0.0	n	n	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	n	n
SrO	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n	n	n	n	n
ZrO2	0.0	0.0	n	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n	0.0	0.0	n	0.0	0.0	0.0
Cr2O3	n	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n	n	0.0	0.0	0.0	0.0	n
CuO	2.3	0.9	0.6	0.4	0.1	1.4	1.4	0.4	4.9	4.3	0.3	0.4	1.4	0.1	0.2	0.4	0.6	0.6	n	0.0
Sb2O5	0.3	0.2	0.2	0.4	0.1	0.7	0.5	0.3	0.7	0.1	1.3	1.1	0.3	0.4	0.4	1.0	0.8	1.0	0.0	0.7
P2O5	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	2.4	0.1	0.1	0.1	0.1	0.1	1.6
ZnO	0.5	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PbO	n	n	n	0.6	n	0.9	0.7	0.4	0.9	0.0	0.3	0.2	5.1	n	1.4	0.3	0.4	0.4	0.0	0.0
V2O3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0	n
NiO																0.0	0.0	0.0	n	0.0
As2O5																0.0	0.0	0.0	n	0.0
Cl																0.8	1.0	1.0	1.1	0.5
Total	99.5	101.7	101.7	101.5	101.8	101.5	102.3	101.3	102.8	103.6	101.6	101.0	101.7	102.4	102.4	104.0	105.2	103.8	101.7	98.1

Inventory no.	C52519/25580	C52519/25316	C52519/26934	C52516/3166	C52519/23450	C52519/40706	C52519/9659	C52519/11818	C52519/24556	C52519/21443	C52516/6384	C52516/4191	C52519/40322	C52519/26835	C52519/40320	C52519/12422	C52519/28104	C52519/27464	C52519/23153	C52519/9725
Sample	KAU 61	KAU 62	KAU 63	KAU 64	KAU 65	KAU 66	KAU 67	KAU 68	KAU 69	KAU 70	KAU 71	KAU 72	KAU 73	KAU 74	KAU 75	KAU 76	KAU 77	KAU 78	KAU 79	KAU 80
Artefact	Raw glass	Tesserae	Tesserae	Tesserae	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel
Colour	pl.Gr	o.Y-Gr.	o.Y-Gr.	o.Y-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl. Y-Gr.	pl. Y-Gr.	pl. Y-Gr.	pl. Y-Gr.	pl. Y-Gr.	Clr.less	Clr.less	Clr.less
Context	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	9th/10th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	Medieval	e.9th C	e.9th C	e.9th C	Modern	e.9th C	e.9th C	e.9th C	e.9th C
Group	High-potassium	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Mixed-alkali	Natron	Natron	Natron	Natron
Na_2O	2.0	16.2	16.2	16.1	16.8	17.2	17.4	16.2	15.9	16.5	16.6	16.4	17.4	17.5	16.3	9.4	16.8	16.9	17.3	16.9
K_2O	15.4	0.6	0.6	0.6	0.7	0.7	0.8	1.1	1.1	0.7	0.9	0.7	0.8	0.8	1.1	6.5	0.7	0.8	0.8	0.8
CaO	10.6	5.8	5.5	5.6	6.7	6.8	6.8	7.1	7.5	7.2	7.1	7.4	6.6	6.9	6.8	11.3	6.6	6.9	6.2	7.1
SiO_2	58.4	70.0	72.4	72.0	75.1	67.9	67.7	66.4	67.1	68.1	66.9	68.5	66.5	67.3	66.1	65.3	66.6	66.8	66.3	67.5
MgO	4.8	0.8	0.7	0.6	0.5	0.7	0.7	0.9	0.9	0.7	0.8	0.7	0.9	0.8	0.9	1.1	0.8	0.7	0.9	0.8
MnO	0.6	0.5	0.3	0.3	0.4	0.7	0.7	0.8	0.7	0.7	0.7	0.9	0.9	0.9	0.7	1.3	0.9	0.7	1.0	0.8
SO_3	0.1	0.3	0.3	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.1	0.2	0.2	0.2	0.2
BaO	0.2	n	n	n	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	n	0.1	0.0	0.0	0.0	0.1	n
Al_2O_3	2.1	2.3	2.2	2.2	2.4	2.3	2.3	2.5	2.4	2.5	2.4	2.5	2.3	2.4	2.5	1.2	2.3	2.4	3.3	2.5
FeO	0.8	0.7	0.6	0.6	0.4	0.6	0.6	0.8	0.8	0.6	0.9	0.6	0.8	0.8	1.1	0.4	0.8	0.7	0.8	0.7
SnO_2	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
TiO_2	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1
CoO	n	0.0	0.0	0.0	0.0	n	n	0.0	0.0	n	0.0	n	n	n	0.0	n	0.0	0.0	0.0	0.0
SrO	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
ZrO_2	0.0	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr_2O_3	n	n	0.0	0.0	0.0	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
CuO	n	1.7	1.7	1.7	0.0	0.0	0.0	0.2	0.1	0.0	0.2	0.0	0.1	0.1	0.4	0.0	0.0	0.3	0.0	0.2
Sb_2O_5	0.9	0.8	1.4	1.4	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.4	0.3	0.5	0.4	0.3	0.3	0.2	0.2
P_2O_5	2.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.1	0.1	0.1	0.1
ZnO	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.1	0.0	0.0
PbO	0.0	2.5	1.3	1.5	0.0	0.1	0.0	0.3	0.2	0.0	0.3	0.1	0.5	0.1	0.9	0.5	0.0	0.1	0.0	0.1
V_2O_3	0.0	0.0	0.0	n	n	0.0	0.0	0.0	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	n	0.0
NiO	0.0	0.0	n	0.0	n	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	n	0.0	0.0
As_2O_5	0.0	n	0.0	0.0	n	n	n	n	n	n	n	n	n	0.0	n	0.0	n	n	0.0	n
Cl	0.5	1.1	1.0	1.0	0.8	1.0	1.0	0.8	0.7	1.0	0.9	1.0	0.8	1.0	0.8	0.8	1.1	0.9	0.9	1.0
Total	98.7	103.5	104.5	104.2	104.4	98.9	99.0	98.0	98.2	98.5	98.7	99.5	98.4	99.2	98.7	98.8	97.4	98.0	98.4	99.1

Inventory no.	C52516/1769	C52519/23406	C52519/20923	C52519/23495	C52519/25068	C52519/40319	C52519/27074	C52519/20997	C52519/11045	C52519/11046	C52519/28915	C52519/16636	C52519/28454	C52519/16886
Sample	KAU 81	KAU 82	KAU 83	KAU 84	KAU 85	KAU 86	KAU 87	KAU 88	KAU 89	KAU 90	KAU 91	KAU 92	KAU 93	KAU 94
Artefact	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Vessel	Bead	Bead	Bead	Bead
Colour	Clr.less	Clr.less	pl.Gr.-Bl.	pl.Gr.-Bl.	pl.Bl.-Gr.	pl.Gr.-Bl.	pl.Gr.-Bl.	pl.Gr.-Bl.	pl.Gr.-Bl.	pl.Gr.-Bl.	Cob.	(o) Cob.	Cob.	Cob.
Context	Medieval	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	e.9th C	Medieval	Medieval	e.9th C	e.9th C	e.9th C	e.9th C
Group	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	Natron	PAG	PAG	PAG	PAG
Na2O	17.4	17.3	16.1	16.7	17.1	16.8	16.7	16.8	16.5	16.5	16.2	15.8	15.6	14.6
K2O	0.8	0.7	1.7	0.7	0.8	1.1	1.0	1.0	1.1	1.1	3.5	3.1	2.7	3.0
CaO	6.5	6.4	7.6	6.9	7.0	7.3	7.2	6.9	7.1	7.2	5.9	6.3	5.0	6.3
SiO2	67.5	72.4	65.7	74.7	67.4	67.4	67.3	67.4	67.3	67.3	67.0	64.4	66.5	62.6
MgO	0.9	0.7	1.0	0.6	0.7	0.8	0.8	0.9	0.8	0.8	4.4	4.4	5.5	5.4
MnO	0.7	0.7	0.7	0.4	0.6	0.7	0.7	0.7	0.6	0.7	0.1	0.4	1.3	0.5
SO3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
BaO	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.1	0.1	0.1	0.0	0.1	0.0	0.1
Al2O3	2.8	2.4	2.7	2.4	2.4	2.5	2.5	2.5	2.4	2.5	1.5	1.8	1.5	1.8
FeO	0.7	0.7	1.0	0.5	0.7	0.8	0.8	0.8	0.7	0.8	0.7	1.0	0.9	0.9
SnO2	n	n	n	n	n	n	n	n	n	n	n	n	n	0.0
TiO2	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
CoO	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0	n	0.0	0.1	0.1	0.1	0.1
SrO	n	n	n	n	n	n	n	n	n	n	n	n	n	n
ZrO2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr2O3	n	0.0	n	0.0	n	n	n	n	n	n	0.0	n	0.0	0.0
CuO	0.0	0.1	0.2	0.0	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.1
Sb2O5	0.3	0.2	0.3	0.1	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.2
P2O5	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2
ZnO	0.0	0.0	n	0.0	0.0		0.0	0.0	0.0	0.0	0.4	0.4	0.1	0.3
PbO	0.0	0.9	0.4	0.0	0.5	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	2.8
V2O3	0.0	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NiO	0.0	0.0	0.0	0.0	n	0.0	0.0	0.0	n	0.0	0.0	0.0	0.0	0.0
As2O5	n	n	0.0	n	0.0	n	n	n	n	n	0.0	0.0	0.1	0.0
Cl	0.7	1.0	0.7	0.6	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.6	0.6
Total	98.9	103.9	98.9	103.9	99.3	99.2	99.2	98.8	98.6	98.9	101.4	99.5	100.9	100.0

Inventory no.	C52516/5356	C52516/3641	C52516/3586	C52516/2967	C52519/13279	C52519/11204	C52519/11318	C52519/11228	C52519/11358	C52519/18833	C52519/28076	C52519/16384	C52519/16313	C52519/18724	C52519/11612	C52519/10069	C52519/15227	C52519/11607	C52519/11565	C52519/10388	C52519/40723	52517/1624
Sample	KAU 95	KAU 96	KAU 97	KAU 98	KAU 99	KAU 100	KAU 101	KAU 102	KAU 103	KAU 104	KAU 105	KAU 106	KAU 107	KAU 108	KAU 109	KAU 110	KAU 111	KAU 112	KAU 113	KAU 114	KAU 115	KAU 116
Artefact	Bead	Rod end	Vessel	Bead	Bead	Bead	Melt	Rod	Window	Raw glass	Bead	Bead	Bead	Bead	Melt	Rod end	Raw glass	Vessel	Bead	Raw glass	Raw glass	Raw glass
Colour	pl.Bl.-Gr.	(o) pl.Bl.-Gr.	pl.Bl-Gr.	pl.Y-Gr.	pl.Bl.-Gr.	(o) pl.Bl.-Gr.	pl.Bl.-Gr.	(o) pl.Bl.-Gr.	pl.Y-Gr.	pl.Bl.-Gr.	Y-Br.-Gr.	Y-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	Y-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	pl.Bl.-Gr.	dk.Br.-Gr.	m.Br.-Gr.	m.Br.-Gr.
Context	9th/10th C	9th/10th C	Modern	9th C	Modern	Medieval	Modern	Medieval	Medieval	Modern	Modern	Medieval	Medieval	e.9th C	Medieval	Modern	Modern	Medieval	Medieval	Modern	Modern	Modern
Group	High-potassium	Natron	Natron	High-potassium	High-potassium	High-potassium	High-potassium	Natron	High-potassium	HLLA	High-potassium	HLLA	Natron	High-potassium	Natron	Natron	HLLA	Natron	High-potassium	Lead-potassium	HLLA	Post-1830
Na_2O	2.2	17.1	17.1	3.2	2.8	2.0	2.2	18.1	2.8	5.5	2.4	1.3	15.9	2.9	16.3	17.3	1.0	16.8	2.2	2.2	3.2	15.2
K_2O	12.7	0.6	1.1	14.0	13.1	15.6	11.6	0.6	13.4	3.2	11.2	6.6	0.2	10.0	1.0	1.7	7.0	0.8	11.9	4.0	5.0	0.3
CaO	12.1	6.0	7.2	11.7	11.6	10.2	14.5	6.3	12.4	19.6	13.1	19.1	9.8	14.3	7.6	7.6	20.2	7.0	12.2	14.9	20.4	10.7
SiO_2	59.8	62.5	65.3	58.6	59.2	58.5	57.8	63.6	57.7	60.2	60.7	60.6	68.3	60.1	68.6	64.9	62.2	65.9	60.3	46.8	57.8	70.8
MgO	5.9	0.8	1.2	6.0	5.8	4.8	5.6	0.9	5.5	3.6	5.9	3.8	0.8	4.5	1.0	1.2	4.2	1.0	5.3	2.5	3.0	0.4
MnO	0.9	0.7	0.7	0.7	0.7	0.8	1.2	0.5	0.6	0.9	0.9	1.8	<0.1	0.8	0.5	0.8	0.7	0.5	1.0	0.3	0.4	<0.1
SO_3	<0.2	0.2	0.2	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	0.2	0.2	0.3	<0.2	<0.2	0.3	<0.2
BaO	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.3	<0.2	<0.2
Al_2O_3	2.3	2.2	2.6	1.5	2.6	3.1	2.8	2.4	2.3	3.2	2.1	3.1	2.3	3.0	2.8	2.9	1.4	2.5	2.7	7.8	4.3	1.8
FeO	0.8	1.0	1.1	0.7	0.9	1.3	1.2	0.8	0.9	0.9	1.0	0.9	0.9	1.3	0.9	1.1	0.5	0.9	1.1	3.5	1.8	0.9
SnO_2	0.0	0.6	0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TiO_2	0.3	<0.1	0.2	0.1	0.4	0.4	0.4	0.2	0.2	0.3	0.3	0.5	0.3	0.4	0.1	0.2	0.2	0.1	0.4	0.2	0.4	0.0
CoO	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CuO	<0.1	1.2	0.3	<0.1	<0.1	<0.1	<0.1	1.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.7	<0.1	<0.1	<0.1	<0.1
Sb_2O_5	<0.2	1.2	0.6	0.3	<0.2	<0.2	<0.2	0.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.9	0.4	<0.2	<0.2	<0.2
P_2O_5	2.1	<0.1	0.2	2.3	2.2	2.5	2.0	0.1	2.2	1.9	1.9	1.7	0.2	2.3	0.2	0.4	2.3	0.1	2.0	1.5	2.6	0.0
ZnO	<0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1	0.2	<0.1	<0.1
PbO	<0.2	4.6	1.2	0.3	<0.2	<0.2	<0.2	2.6	1.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.5	<0.2	1.6	<0.2	14.8	<0.2	<0.2
Cl	0.5	1.1	0.9	0.6	0.7	0.7	0.4	1.1	0.6	0.9	0.5	<0.2	1.3	0.5	0.8	0.9	<0.2	1.0	0.5	<0.2	0.7	<0.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 9.24 *EDX samples from Kaupang.*

	All natron glasses (N=83)		Transparent glass (N=62)		Opaque glass (N=21)		Vessel glass (N=42)		Tesserae (N=9)	
Oxides	Mean	St.dev.	Mean	st.dev.	Mean	st.dev.	mean	st.dev.	Mean	st.dev.
Na2O	17.7	1.2	17.5	1.1	18.0	1.4	17.5	1.0	17.7	1.7
K2O	0.8	0.3	0.9	0.3	0.7	0.1	1.0	0.3	0.7	0.1
CaO	6.8	0.7	6.9	0.7	6.3	0.6	6.9	0.4	6.3	0.8
SiO2	66.8	3.1	67.3	2.5	65.1	4.0	67.2	2.3	67.1	3.9
MgO	0.9	0.4	0.9	0.4	0.9	0.4	1.0	0.4	0.9	0.5
MnO	0.6	0.2	0.6	0.2	0.6	0.2	0.7	0.2	0.5	0.3
SO3	0.2	0.1	0.2	0.1	0.3	0.1	0.2	0.0	0.3	0.0
BaO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al2O3	2.4	0.2	2.4	0.2	2.3	0.1	2.4	0.2	2.3	0.2
FeO	0.9	0.3	0.8	0.2	0.9	0.5	0.8	0.3	0.7	0.2
SnO2	0.2	0.9	0.0	0.1	0.9	1.6	0.0	0.0	0.0	0.0
TiO2	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
CuO	0.5	0.7	0.4	0.7	0.8	0.7	0.3	0.5	1.3	0.8
Sb2O5	0.6	0.5	0.5	0.4	0.8	0.7	0.3	0.2	1.3	0.7
P2O5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.1
ZnO	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
PbO	0.9	2.1	0.4	0.7	2.4	3.6	0.3	0.5	1.4	1.6

Table 9.25 *Mean elemental values and their standard deviations in different sub-samples of natron glass at Kaupang. The modern samples KAU 13 and 116 are excluded.*

Conclusions

Six main compositional groups were identified (Figs. 9.43, 9.57–8; Tabs. 9.25–6). The majority of the analysed samples consist of low-magnesium soda-lime-silica glass (hence *natron* glass), the production of which is essentially a continuation of Roman glass technology.[27] Some samples also correspond to the Early Islamic high-magnesium soda-lime silica glass (hence *soda plant-ash* glass or PAG) first distinguished by Sayre and Smith (1961). There are also three main types of glass fluxed with potassium: a *high-potassium* type; a second, more diffuse group with a *high-lime* and *low total alkali content* (hence HLLA); and a small number of samples of *lead-potassium* glass. These glasses probably originated within the Carolingian realm. Finally, two samples should be categorised as *mixed-alkali* glasses because of their nearly equal contents of sodium and potassium fluxes. Other samples also indicate the extensive mixing of different colours and qualities of glass (see below).

The *natron* glass comprises most of the beadworking waste and nearly all of the vessel-fragments. Its composition varies considerably, and colouring, recycling and mixing have made it difficult to correlate the samples with published and provenanced groups of fresh natron glass (e.g. Freestone 2005:tab. 1, appendix 1). Overall, the composition corresponds to glass from Levantine factory sites circulating in the western Mediterranean area throughout the Early Medieval Period into the 9th century AD (Foy et al. 2003:group 3; Whitehouse 2003, with refs.; Silvestri et al. 2005:group A 2/1). KAU 17, 45 and 59 correspond to high-calcium glass from Egypt (Freestone 2005:Egypt II).

Variation in the use of antimony, tin-based and other colouring agents, and the saturation of metallic elements in the glasses, indicate that the origin of the glass and the level of recycling vary significantly (Tab. 9.25; Henderson 1999; Freestone et al. 2002:266–8). The beadworking material is generally characterised by high levels of recycling,[28] and blending of both Roman and Early-medieval glass can be documented. These patterns are not replicated in contemporary raw-glass groups but are found in glass from western and southern Europe associated with recycling and secondary colouring (e.g. Uboldi and Verità 2003; Wedepohl 2003:tabs.18–19).

27 The absence of manganese, chlorine and sulphur in KAU 116 and the high silica and calcium content and low impurity levels in KAU 13 suggest that these samples are 19th- or 20th-century glasses. The samples have been excluded when calculating the compositional means in Table 9.25.

28 Elevated levels of metallic elements are also replicated in the vessel-fragments KAU 41 and 75.

	PAG (N=5)		High-potassium (N=14)		HLLA (N=5)		Lead-potassium (N=4)		Mixed-alkali (N=2)	
Oxides	Mean	St.dev.	Mean	st.dev.	Mean	St.dev.	Mean	St.dev.	Mean	st.dev.
Na_2O	15.9	0.9	2.4	0.4	2.6	1.8	1.8	0.3	9.8	0.6
K_2O	3.1	0.3	12.2	2.1	5.0	1.9	3.9	0.2	9.3	4.0
CaO	6.1	0.7	12.9	1.8	21.1	2.9	14.1	0.7	8.9	3.4
SiO_2	64.8	1.9	59.2	1.1	59.7	1.9	44.1	1.8	65.6	0.4
MgO	4.9	0.5	5.4	0.5	3.6	0.5	2.5	0.0	0.8	0.3
MnO	0.6	0.5	0.8	0.2	0.8	0.6	0.3	0.0	0.9	0.6
SO_3	0.3	0.0	0.0	0.1	0.3	0.2	0.0	0.0	0.1	0.1
BaO	0.0	0.0	0.1	0.1	0.1	0.1	1.3	0.6	0.0	0.0
Al_2O_3	1.7	0.2	2.6	0.7	2.9	1.0	7.2	0.8	1.7	0.7
FeO	0.8	0.2	1.1	0.3	1.1	0.5	2.4	0.7	0.5	0.1
SnO_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TiO_2	0.1	0.0	0.3	0.1	0.3	0.2	0.2	0.0	0.1	0.0
CuO	1.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sb_2O_5	0.2	0.0	0.3	0.3	0.0	0.1	0.5	0.3	0.6	0.2
P_2O_5	0.2	0.0	2.1	0.3	2.0	0.4	1.5	0.3	0.2	0.1
ZnO	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0
PbO	0.6	1.3	0.1	0.4	0.0	0.0	18.1	2.5	0.4	0.2

Table 9.26 *Mean elemental values and their standard deviations in analysed soda plant-ash glass. potassium-fluxed glasses and mixed alkali glasses from Kaupang.*

The majority of vessel-glass fragments are distinguished by considerably lower levels of metallic elements. *It can be inferred that the material came from two distinct stocks of glass*, and that a two-tier distribution system was in place. While beadworkers generally applied recycled glass and used more *ad hoc* sources for their raw materials, vessel production must have been based on fresh glass from factory sites to a much greater extent.

Isotope analyses confirm the mixed origin of the natron glass from Kaupang (Gaut et al., in prep.). The Nd and Sr signatures indicate that KAU 35a, KAU 45 and KAU 62 were all made using a mineral sodium source and coastal sand deposits. The low concentration of strontium in KAU 59 is replicated in glass from the inland site of Tel Asmunein in Egypt and indicates the use of mineral sodium but a different silica/lime source. The Sr87/86 signature of KAU 64 is unlike any published reference material and is currently unexplained.

Pure *soda plant-ash* glass is only found in imported drawn and segmented E- and F- beads at Kaupang (KAU 50 and 91–4, Tab. 9.26). Analytical work on glass from Al-Raqqa in Syria has indicated an initial experimental phase when sodium-rich plants replaced mineral sodium as the alkali source in parts of the Middle East from the late 8th and 9th centuries, with variations in the mixing of raw materials (Henderson et al. 2004). Published material from other furnace sites such as Banias and Nishapur (Henderson 2003; Freestone et al. 2003) suggests that the composition also varied geographically.

Isotope analyses show that the two analysed PAG beads (KAU 91 and 92) originated in two separate locations – KAU 91 probably from terrestrial Syria (Gaut et al., in prep.). The difference in origin is also reflected in the production technique and glass quality of the beads (Gry Wiker, pers. comm.).

The slightly elevated levels of magnesium and potassium in several vessel glasses and one raw glass sample (KAU 1, 35, 35a, 36, 39 and 45) suggest that natron glass was deliberately blended with plant-ash glasses in Western Europe to achieve brilliant blue glass for use in vessel production.

Production of *potassium-fluxed* glasses started in parts of the Carolingian realm in the last decades of 8th century (Wedepohl 2003:91–6; Krueger and Wedepohl 2003:93–5). Small quantities of raw-glass fragments, beadworking waste and annular beads of transparent green potassium-rich glass have been identified at Kaupang (Tab. 9.26). None of the samples had been deliberately coloured.

Although very few samples come from stratified deposits, both the *HLLA* and the *high-potassium* composition resembles 9th and 10th century potassium-fluxed glasses reported earlier (Wedepohl 2003:91–6, tab. 6A). A Viking Age date is also corroborated by a polychrome high-potassium B545 bead (KAU 95) and a monochrome A340g bead of HLLA composition (KAU 106). A small number of potassium-fluxed raw glass fragments also derive from stratified Viking contexts (KAU 4, 5, 54, 60 and 61). The higher frequency of potassium-rich glass in the ploughsoil assemblage suggests that the circulation of this glass increased during the second half of the 9th century.

The variable level of sodium found in much of the early potassium-fluxed glass suggests that the group also contained small natron glass components. Two other samples suggest a more deliberate and even mixing of potassium-fluxed and natron based glasses in western Europe (hence *mixed-alkali glass*). KAU 76 is, so far, the only indication at Kaupang that potassium-fluxed glass could be used in vessel production. KAU 21 is a blue semi-translucent tessera. The sample probably represents the Carolingian manufacture of tesserae and glass tiles used to decorate palaces, monasteries and churches in a neo-Antique style (Lobbedey et al. 2001; Kind et al. 2003:85–8).

The identified linen smoothers of *lead-potassium glass* (KAU 7–9 and 114) are very distinct; defined by a low total alkali content and high lead and aluminium values. This glass was most probably made from a slag by-product of Carolingian silver extraction. Lead isotope analyses confirm that the glass corresponds to the ore exploited at Melle, Dept. Deux-Sèvres, near Poitiers (Gratuze et al. 2003b; Guerrot 2007), and the glass probably originates in that area.

Appendix 9.2
Glass from graves at Kaupang

A number of cemeteries surround the settlement area at Kaupang, most prominent amongst them Nordre Kaupang, Hagejordet, Lamøya, Bikjholberget and Søndre Kaupang. These have been partly excavated in an intermittent series of campaigns from the second half of the 19th century until the 1970s, and the finds published under the auspices of Charlotte Blindheim (Blindheim et al. 1981, 1995, 1999). More recently, fresh survey work and a desktop assessment has provided new information with regard to the character and extent of the cemeteries at the Kaupang farms and Lamøya (Kristensen and Berg-Hansen 2005; Skre 2007f; Stylegar 2007).

Finds from a total of 204 graves have been recorded. The original number of burials must have been much higher, possibly around a thousand (Stylegar 2007:75–8). A substantial number of barrows and unmarked graves have been destroyed through agricultural intensification, and only some 110 monuments are preserved in the landscape today (Kristensen and Berg-Hansen 2005).

Apart from beads, artefacts of glass are almost never present in documented finds (Blindheim el al. 1999:53–7 and 123). A small number of objects including rod-fragments, a tessera and a pseudo-cameo brooch inlay have been recovered. A handful of graves in the cemetery at Bikjholberget also contained fragments of vessel glass (Tab. 9.27). These fragments represent six individual vessels (EMN, N=11), and the identifiable sherds include two different funnel beakers and one jar. One additional sherd (C54272/9), recovered during a surface survey of the cemetery at Nordre Kaupang, is also likely to originate from a disturbed grave (cf. Kristensen and Berg-Hansen 2005).

The excavated deposits were not sieved, and it is possible that some vessel sherds were overlooked. Nevertheless, with the possible exception of the five sherds in Ka. 304, it is unlikely that complete vessels were deposited in the graves. In many cases it is also difficult to know whether the sherds represent grave goods, material from older disturbed graves, or settlement debris accidentally included in the backfill (e.g. Ka. 303 and Ka. 304: Blindheim et al. 1999:53–4). Hougen (1969a) and Blindheim (et al. 1999:56–7) have suggested that the fragments could have been regarded as tokens of prestige items. It should, however, be noted that finds of individual or small collections of vessel sherds are not unusual in graves, presumably kept as dress accessories, keepsakes or amulets, or for their recycling value (e.g. Arbman 1937:58, fig. 9; Hougen 1968:94–5, 104; Hinton and White 1993; Henricson 1995; Mehling 1998).

Whatever the glass represented to the deceased and their families, the frequency of deposition of glass was very low at Bikjholberget, with a peak in the late 9th century.[29] The poverty of glass in the graves contrasts starkly with both the cornucopia of glass uncovered in the settlement area and the many grave finds from Birka (Arbman 1937). A sensible conclusion is that the deposition of vessel glass, like pottery, did not play a significant part in the burial custom of Vestfold at this particular time (Hougen 1993:8–9; Blindheim et al. 1999:53). Indeed the overall number of recorded Scandinavian Viking-period graves containing vessel glass is small (Fig. 9.2.a). This is also true of other Scandinavian, Slavonic and mixed-rite cemeteries associated with settlements from where significant glass assemblages have been recovered (e.g. Helgö: Lundström 1981; Hedeby: Steppuhn 1998; Paviken and Åhus: Sode 2004:88; Groß Strömkendorf: Pöche 2005; Ribe: Lund Feveile 2006). The Birka finds are the only exception. The lack of vessel glass in the Kaupang graves consequently says little about the wider availability of glass in society.

29 The grave attributed to the late 10th century by Blindheim (Ka 277) should possibly be dated slightly earlier (Stylegar 2007:81–2).

Context	Intervention	Artefact-type	Description	Notes
Ka. 3 (900–950)	N. Kaupang, Nicolaysen 1867	1 lump of melted glass.	Lost (green).	Possibly a melted bead. Blindheim et al. 1981:200.
Ka. 4 (900–950)	N. Kaupang, Nicolaysen 1867	1 vessel sherd	Lost. (Thick, dark brown. Probably a modern intrusion.)	Blindheim et al. 1981:201.
Ka. 125 (800–900)	Hagejordet (N. Kaupang), private find 1867	1 pseudo-cameo brooch inlay	Cast disc with cruciform design and cones in high relief; fragmentary (21.4 x 20.8 mm, thickness: 1.5–4.5 mm); opaque grey-white glass with small impurities; scarred surface; iron corrosion on obverse.	Inlay dated 750/75–800/825. Blindheim et al. 1981:211–2; Gaut 2006:fig. 2.
Ka. 205 (undated)	Lamøya, Gustafson 1902	1 rod	Translucent v. light green-blue, twisted from two flattened rods. Deep grooves, irregular shape. Tapering towards one side 31.1 x 2.3–3.1 mm.	Blindheim et al. 1981:215.
Stray find	Surveywork 2005	1 vessel sherd	Very light blue-green, white marvered trails.	Kristensen and Berg-Hansen 2005.
Ka. 37 (850–900)	N. Kaupang 1958	1 tessera	Semi-translucent cobalt-blue. Near complete cube, one surface broken off. 11.1 x 5.5 x 7.1 mm (fragm. side). (Orig. published as fragm. of a bangle.)	Blindheim et al. 1981:221, pl. 82.
Ka. 127 (undated)	Hagejordet (N. Kaupang) 1974	2 pieces of slag	Lost (Described as 'glassy'. One of the fragments has toolmarks.)	Disturbed context. Blindheim et al. 1981:223.
Ka. 301 (860–900)	S. Bikjholberget 1954 Grave I	1 vessel sherd	Undiagnostic wall sherd (light green); near rectangular (23.8 x 16.1 mm, thickness: 2.5–3.6 mm); one edge possibly heat exposed; slightly matted, scratched and worn edges.	Redeposited from Ka.303 below? Blindheim and Heyerdahl-Larsen 1995:29–30, pl. 22.
Ka. 303	S. Bikjholberget 1953 Grave I		(1 vessel sherd attributed to this grave probably belongs to Grave II below)	Blindheim and Heyerdahl-Larsen 1995:29–30.
Ka. 304 (800–850)	S. Bikjholberget 1953 Grave II	5 vessel sherds (high wall section of v. light blue-green funnel beaker).	A: Concave wall sherd (20.5 x 13.3 mm, thickness 1.0–1.2 mm); sherd link to E (total length 28 mm). B: Concave wall sherd (20.5 x 13.7 mm, thickness: 0.8–1.0 mm); possible sherd link to C (total length 30 mm). C: Concave wall sherd (19.7 x 14.8 mm, thickness 0.7–0.8 mm). D: Concave wall sherd (10.8 x 6.8 mm, thickness: 1.1–1.2 mm). E: Concave wall sherd (17.0 x 6.8 mm, thickness: 1.1–1.3 mm).	Blindheim and Heyerdahl-Larsen 1995:30–32, pl. 25.
Ka. 305 (850–900)	S. Bikjholberget 1955	3 vessel sherds	A+B: Linked medium green-blue *in calmo* rim-fragments (Type 6a) from funnel beaker (total length 9.6 x 8.0 mm, thickness: 1.2–1.6 mm). C: Undiagnostic light yellow-green wall sherd; convex (16.8 x 8.3 mm, thickness: 2.4–2.5 mm); slightly matted surface.	Stylegar (2007) dates the grave to c.900. Blindheim and Heyerdahl-Larsen 1995:32–34, pl. 27.
Ka. 315 (800–900)	S. Bikjholberget	1 rod	Lost (Twisted, green).	Blindheim and Heyerdahl-Larsen 1995:43–4.
Ka. 277 (950–1000)	N. Bikjholberget 1954 Grave I	1 vessel sherd	*In calmo* rim-fragment (Type 6b, 35–45° angle) probably from small jar (25.1 x 8.5 mm, thickness: 1.7–2.5 mm). Dichroic (opaque red in *reflected* light; *translucent* medium green-blue in *transmitted* light).	Blindheim and Heyerdahl-Larsen 1995:76–7, pl. 67.
Ka. 284 (900–950)	N. Bikjholberget 1954 Grave IX	1 vessel sherd	Undiagnostic body fragment (8.3 x 7.5 mm, thickness: 0.7 mm); translucent matrix flashed with opaque brown-red glass; decorated with three horizontal white trails.	Blindheim and Heyerdahl-Larsen 1995:83, pl. 80.

Table 9.27 *Glass finds from the cemeteries surrounding Kaupang. The table does not include glass beads.*

Appendix 9.3
Sherd Families

Sherd Family 1

Very light blue-green jar; white trailing and reticella decoration. Body diameter c. 9 cm. Fig. 9.62.bi
Reconstruction: Fig. 9.21. Distribution: Fig. 9.41.

Inventory no.	Context	Comment
C52516/4537	AL16646, SP I–III, CRM Plot 4B	Links to 4191and 11253.
C52516/4191	Later medieval plough-layer	Links to 4537. Analysis: KAU 72
C52519/11253	Later medieval plough-layer	Links to 4537
C52519/21443	AL74121. Refuse layer east of Plot 3A. SP II:2, Plot 3A	Analysis: KAU 70

Sherd Family 2

Very light green-blue jar, almost completely covered by ruby red and black streaks; white trailing and reticella decoration. Globular body and tapering rim; rim diameter 8–9 cm. Fig. 9.62.bk-bo.
Reconstruction: Fig. 9.16. Distribution: Fig. 9.38.

Inventory no.	Context	Comment
C52519/ 9966	Cleaning below modern ploughsoil	Links to 24027
C52519/24047	Refuse layer (AL64612, spit 2). SP II:1, Plot 1A	Links to 9966
C52519/10223	Second cleaning of activity layer in building A200 (AL50435). Probably SP II:1, Plot 1A	
C52519/11883	Later medieval plough-layer	
C52519/11838	Fill of modern trench E. of Plot 1/2A.	Reticella decoration like 9966
C52519/10068	Cleaning layer below modern ploughsoil	
C52519/12374	Modern ploughsoil	
C52519/9925	Dumping zone. SP I–III	Rim
C52519/19484	Modern ploughsoil	Reticella decoration like 9966
C52519/11391	Demolition layer (AL42042). SP I–III, Plot 4B	
C52519/11999	Floor deposit (AL47590). SP I–III, Plot 4B	
C52519/11962	Refuse layer (AL46995). SP I–III, Plot 4B	Rim

Sherd Family 3

Jar of flashed, marbled red glass; white reticella decoration. Probable body diameter 10–11 cm. Fig. 9.62.bj.
Reconstruction: Fig. 9.17. Distribution: Fig. 9.36.

Inventory no.	Context	Comment
C52519/20254	Metalworking waste in ditch. SP II:1, Plot 1A/B	Links to 9997. Analysis: KAU 42–3
C52519/9997	Cleaning below modern ploughsoil	Links to 20254 and 21703
C52519/21703	Refuse layer. SP II:1, Plot 1A	Links to 9997 and 12257
C52519/12257	Later medieval plough-layer	Links to 21703
C52519/25061	Fill post-hole. SP II:1, Plot 1A	
C52516/3869	Charcoal/workshop horizon. SP I–III, CRM, Plot 1B	
C52519/9988	Cleaning below modern ploughsoil	
C52519/10655	Cleaning below modern ploughsoil	
C52519/12155	Modern ploughsoil	
Possibly associated		
C52517 /2514	Surface find, 30 m E of MRE trench.	

Sherd Family 4

Very light blue-green sherds; marvered and unmarvered opaque white trails. Fig. 9.62.ar-as. Reconstruction: Fig. 9.24. Distribution (of stratified sherds): Fig. 9.31

Inventory no.	Context	Comment
C52519/11646	Refuse layer AL43552. SP I–III, N of Plot 4A.	Links to 12329
C52519/10057	Modern ploughsoil	Links to 12329
C52519/12329	Fill AL20665, spit 2. SP I–III, E of Plot 4A.	Links to 10057 and 11646
C52519/10136	Fill AL20665, spit 2. SP I–III, E of Plot 4A.	
Possibly associated		
C52516/6382	AL16646. SP I–III, CRM, Plot 4B	
C52519/9659	AL26473. SP I–III, E of Plot 4A	Analysis: KAU 67
C52519/40706	Fill AL20665, spit 2. SP I–III, E of Plot 4A.	Analysis: KAU 66
Possibly associated		
C52519/10660	Cleaning below modern ploughsoil	Undecorated

Sherd Family 5

Light yellow-green funnel-shaped beaker; marvered white trailing and simple internal folded rim. Fig. 9.62.at. Reconstruction: Fig. 9.14. Distribution: Fig. 9.36.

Inventory nr.	Context	Comment
C52519/19666	Fill of ditch between 3A and 4A. SP II:2, Plot 3A	Links to 26087
C52519/26087	Refuse layer. SP II:1, Plot 3A	Links to 19666, 24799 and possibly 26835
C52519/24799	SP I, Plot 2A *(intrusive)*	Links to 26087
C52519/26835	Stake hole (Fence line A404). SP II:1, Plot 2A	Possible link to 26087. Analysis: KAU 74
C52519/28367	Section, modern drainage. Without SP Plot 3A/2A.	
C52519/20975	Refuse layer in ditch. SP II:1, Plot 2A/B	
C52519/11179	Later medieval plough-layer	
C52519/11301	Later medieval plough-layer	
C52519/28087	Floor deposit, A301. SP II:2, Plot 3B	Analysis: KAU77
C52519/28104	Refuse layer outside building A301. SP II:2, Plot 3B	
Possibly also associated		
C52519/38372	Modern ploughsoil	SF 5 or SF 13?
C52519/40322	Floor deposit, A302. SP II:2, Plot 3A	Probable link to 21524. Analysis: KAU 73, just outside the margins of statistical error for KAU 74 and KAU 77.
C52519/21524	Floor deposit A302. SP II:2, Plot 3A	Probable link to 40322

Sherd Family 6

Very light blue-green funnel beaker; applied dark green-blue rim with minimal external fold (Type 7a). Rim height 9.8 mm. Rim diameter c. 11 cm. Fig. 9.62.az.

Inventory no.	Context	Comment
C52519/22663	Fill of pit A43852. Plot 3B	Links to C52516/2705
C52516/2705	Later medieval plough-layer (AL100, spit 2)	Links to C52519/22663

Sherd Family 7

Dark green globular jar; constricted neck and everted rim. Horizontal yellow-white trails; zone of marvered and arcaded, or combed and feathered, decoration on body. Rim diametre 10.5 cm. Fig. 9.62.w-y. Reconstruction: Fig. 9.20. Distribution: Fig. 9.41.

Inventory no.	Context	Comment
C52519/12683	Later medieval plough-layer	
C52519/38382	Cleaning below modern ploughsoil	
C52516/1303	Later medieval plough-layer, CRM trench	
C52516/4193	Later medieval plough-layer (AL100, spit 3). CRM trench.	Rim

Sherd Family 8

Light green-yellow globular jar; marvered and feathered white trails. Bubbly matrix. Fig. 9.62.ah-ai. Reconstruction: Fig. 9.18. Distribution: Fig. 9.41.

Inventory no.	Context	Comment
C52519/11328	Later medieval plough-layer	
C52519/19912	Modern ploughsoil	
C52519/29001	Modern ploughsoil	
C52516/4192	Later medieval plough-layer	
C52516/2584	Later medieval plough-layer	

Sherd Family 9

Dull light grey-green funnel beaker; vertical marvered white trails from base to rim. Fig. 9.62.by.

Inventory no.	Context	Comment
C52519/17215	SP II:2, Plot 2A	Base
C52519/10021	Cleaning below modern ploughsoil	Rim
C52519/11210	Later medieval plough-layer	

Sherd Family 10

Colourless vessel-fragments; marvered yellow and unmarvered white trailing. Fig. 9.62.ae-ag. Distribution: Fig. 9.38.

Inventory no.	Context	Comment
C52519/29002	Modern ploughsoil	
C52519/10241	Cleaning below modern ploughsoil	
C52519/24587	Refuse layer, partly filling ditch between plots 2B/3B. SP II:1, 2B	
C52519/20375	Sand-fill in pathway between Plots 1A and 2A. SP II:1, Plot 1A	
C52519/12378	Modern ploughsoil	Only marvered yellow decoration preserved
C52519/23406	Fill in pit A84610, SP II:1, Plot 3B	Only marvered yellow decoration preserved. Analysis: KAU 82
C52519/11926	Medieval 'road fill' across settlement	Only marvered yellow decoration preserved
C52519/16582	Refuse layer, partly covering ditch between plots 2A/B. SP II:2, Plot 2B	Only marvered yellow decoration preserved
Uncertain association		
C52519/9712	Fill modern drainage trench T35835	Undecorated
C52519/21975	Floor deposit A406. SP II:1, Plot 2A	Undecorated
C52519/27957	Floor deposit A406. SP II:1, Plot 2A	Undecorated

Sherd Family 11

Very light blue-green cone or funnel-shaped beaker. Fig. 9.62.b. Distribution: Fig. 9.31.

Inventory no.	Context	Comment
C52516/3162	Shallow pit (A11958) below A100. SP I–III, CRM Plot 3B.	
C52516/6383	Shallow pit (A11958) below A100. SP I–III, CRM Plot 3B.	
C52516/6384	Shallow pit (A11958) below A100. SP I–III, CRM Plot 3B.	Analysis: KAU 71
Possibly also associated		
C52516/2574	Later medieval plough-layer (A100, spit3). CRM, Plot 4B	
C52519/11573	Later medieval plough-layer, Plot 3B	

Sherd Family 12

V. Light green-blue funnel beaker. Fig. 9.62.d, p. Distribution: Fig. 9.37.

Inventory no.	Context	Comment
C52519/18812	Floor deposit, A301. SP II:2, Plot 3B	
C52519/18682	Floor deposit, A301. SP II:2, Plot 3B	
C52519/18683	Floor deposit, A301. SP II:2, Plot 3B	Melted sheet
C52519/40317	Floor deposit, A301. SP II:2, Plot 3B	
C52519/40318	Floor deposit, A301. SP II:2, Plot 3B	
C52519/40319	Floor deposit, A301. SP II:2, Plot 3B	Analysis: KAU 86
C52519/27074	Refuse from hearth, A47445 (A301). SP II:2, Plot 3B	Analysis: KAU 87
C52519/11045	Later medieval plough-layer	Analysis: KAU 89
C52519/11046	Later medieval plough-layer	Analysis: KAU 90
Possibly associated		
C52519/20997	Floor deposit, A302. SP II:2, Plot 3A	Analysis: KAU88

Sherd Family 13

Very light yellow-green conical or funnel-shaped beaker. Distribution: Fig. 9.37.

Inventory no.	Context	Comment
C52519/18655	Floor deposit, A301, SP II:2, Plot 3B	
C52519/40320	Floor deposit, A301, SP II:2, Plot 3B	Analysis: KAU 75
C52519/28187	Fill of ditch between 3A and 4A. SP II:2, Plot 3A	
Possibly also associated		
C52519/38372	Modern Ploughsoil.	SF 13 or SF 5

Sherd Family 14

Nearly colourless yellow-green glass decorated with heavily melted white/yellow and self-coloured reticella and (possibly) marvered trails. Fig. 9.62.bg.

Inventory no.	Context	Comment
C52516/73	Cleaning, below modern ploughsoil	
C52516/193	Cleaning, below modern ploughsoil	
C52516/5777	Cleaning, below modern ploughsoil	
Possibly associated		
C52516/1163	Later medieval plough-layer, CRM, Plot 4B	
C2519/2519	Surface find, 80 m SE of plateau concentration.	
C52264/5 (496)	Surface find 110 m NE of plateau concentration	Very similar decoration to C52516/73

Sherd Family 15

Undiagnostic very light green-blue vessel. Fig. 9.6.n. Distribution: Fig. 9.27.

Inventory no.	Context	Comment
C52519/23450	Outdoor activity or refuse layer. SP I, Plot 2A	Analysis: KAU 65
C52519/23495	Outdoor activity or refuse layer. SP I, Plot 2A	Analysis: KAU 84

Sherd Family 16

Very light blue palmcup/funnel beaker; horizontal carination. Fig. 9.62.e. Reconstruction : Fig. 9.13. Distribution: Fig. 9.28.

Inventory no.	Context	Comment
C52519/18573	Refuse layer. SP II:1, Plot 1A	
C52519/24595	Activity layer. SP II:1, Plot 2A	
C52519/27596	Refuse layer, outside building A200. SP II:1, Plot 1A	
Possibly associated		
C52519/11341	Fill ditch between plots 3B/4B. SP II:2, Plot 3B	Matrix slightly less bubbly

Sherd Family 17

Undiagnostic matted very light green vessel.

Inventory no.	Context	Comment
C52519/24030	Refuse layer. SP II:1, Plot 1A	
C52519/40315	Later medieval plough-layer	

Sherd Family 18

Undiagnostic medium blue vessel. Fig. 9.62.j.

Inventory no.	Context	Comment
C52519/24204	Dumping zone. SP II:1, Plot 1A	
C52519/26130	Levelling layer. SP II:1, Plot 2A	Retouch?
C52519/9754	Refuse layer in zone between Plot 4B/5. Unrelated.	
C52519/15063	Fill depression AL20665. Unrelated	

Sherd Family 19

Undiagnostic (near) colourless green vessel; thin unmarvered horizontal yellow trails (set with some distance between). Fig. 9.62.ac.

Inventory no.	Context	Comment
C52519/10756	Cleaning below modern ploughsoil	
C52519/11173	Medieval agricultural horizon	

Sherd Family 20

Very light blue-green vessel; yellow reticella and trailing. Probably from a jar or bowl. Fig. 9.62.be-bf.

Inventory no.	Context	Comment
C52519/10385	Modern ploughsoil	
C52517/2136	Modern ploughsoil	
C52517/2352	Modern ploughsoil	Only trailed

Sherd Family 21

Very light green-blue fragments, probably from a funnel beaker. Distribution: Fig. 9.31.

Inventory no.	Context	Comment
C52519/10092	Fill depression, AL20665. Unrelated	
C52519/12315	Fill depression, AL20665. Unrelated	
C52519/9929	Dumping zone	Funnel beaker
C52519/40321	Dumping zone	

Sherd Family 22

Undiagnostic light green-blue vessel; matted and layered matrix. Distribution: Fig. 9.31.

Inventory no.	Context	Comment
C52519/11822	Below Later medieval plough-layer, Plot 5 area	
C52519/9751	Refuse layer in zone between plots 4B/5	

Sherd Family 23

Undiagnostic, near colourless vessel; thin white trails.

Inventory no.	Context	Comment
C52519/27464	Back fill, recutting of pit A43852. SP III, Plot 3B	Undecorated. Analysis: KAU 78
C52519/9725	AL 36314. SP I-III, E of Plot 4A	Analysis KAU 80. Decoration and matrix like C52519/11788
C52519/11788	Later medieval plough-layer	White trails only.

Sherd Family 24

Very light green-blue funnel beaker.

Inventory no.	Context	Comment
C52519/11818	SP I-III, N of Plot 4A	Analysis: KAU 68
C52519/24556	Demolition layer above building A301. SP II:2, Plot 3B.	Analysis: KAU 69

The Pottery

10

LARS PILØ

The pottery assemblage recovered at Kaupang during the fieldwork of 1998–2003 consists of 35,480 g/5,309 sherds, of which 14,015 g/1,726 sherds are from stratified contexts in the main research excavation of 2000–2002 (MRE). The pottery is highly fragmented and it is generally hard to be sure of the shape of the pots. For this analysis, therefore, the pottery has been divided into groups based on the fabric, rim-shapes, and decoration.

The wares represented are mainly Scandinavian and Slavonic grey wares, Frisian shelly ware and Continental wheel-thrown wares: Vorgebirge wares, Tating Ware and Mayen wares. Rarer wares represented include a possible sherd of early Huy glazed Ware, eight sherds of a costrel in red-painted buff ware, and a few sherds suspected of being French white wares. The assemblage also includes a few Late-medieval sherds and some 16th- to 19th century pottery.

A major obstacle to the analysis of the distribution of the various wares in the stratigraphic sequence is the fact that the most common wares – the Scandinavian and Slavonic grey wares – are very difficult to distinguish in the case of undecorated body sherds. Thin-section and ICPS analysis has been undertaken on 36 sherds of coarse grey ware which were believed to represent well-defined fabrics or to have arrived with pioneer settlement. However, this analysis did not yield clear results as to the origin of the grey wares. This is due to the indistinct geological traits of south-western Scandinavia. ICPS analysis of a sherd of red-painted buff ware from a costrel of the Zelzate type has pointed to the Vorgebirge area as the place of production.

The pottery assemblage fits well with a start-date of the settlement at c. AD 800, but a few sherds are of 8th- or even 7th-century origin. Wares from the Vorgebirge area seem not to have arrived after c. AD 880 as neither the Hunneschans horizon or Pingsdorf Ware are represented at Kaupang. No English wares have been recovered, nor any definitely 10th-century pottery has been recovered.

Pottery came to Kaupang mainly as incidental imports on boats. Only the Tating-ware jugs were imported to Kaupang as trade goods, i.e. as tableware. Once there, the pottery was used on the site, but sometimes pragmatically, as when ceramic vessels from the Continent were used for cooking even though their original functions were as wine jugs or containers.

The average Scandinavian Viking-age visitor to Kaupang would have been amazed by the number of strange or exotic objects that were being used and exchanged within the town – cornelian beads, silver dirhams and Mayen quernstones to name but a few. If the visitors to the site were from present-day Norway they would probably have been particularly intrigued by the large-scale use of pottery for cooking and storage – a feature of the material life most other visitors would not have noticed as anything extraordinary, except perhaps because of the limited range of types of pottery present. The reason for this difference is of course that the Viking-age inhabitants of what is now Norway hardly used pottery, in contrast to its large-scale use in most other parts of northern Europe.

There are in fact very few finds of pottery from Norwegian Viking-period settlement sites other than Kaupang. The only imported ware which has appeared outside Kaupang to date is Tating Ware, in a few sherds. Domestic pottery production in the Viking Period was very limited, known so far only in burials and settlement sites in Rogaland. These vessels are bowl-shaped with straight or slightly inverted rims, very similar to Jutlandic hemispherical bowls. The low quality of the pottery suggests that this was probably household production for personal use or for limited distribution in the immediate area (Hougen 1993:15).

The lack of finds elsewhere in Norway indicates that the pottery which came to Kaupang over the sea from southern Scandinavia, the Slavonic areas and further east, or further south, was barely distributed further outside Kaupang itself – with the possible exception of the Tating jugs. This implies that the pottery arrived at Kaupang not as a commodity in itself but primarily as containers for other trade goods, or incidentally, for instance, cooking pots used on the ships travelling to Kaupang. There was no market for ordinary pottery in Viking-period Norway, where the locals used vessels made of soapstone or iron for cooking and wooden containers for storage and other purposes.

At face value, the pottery from Kaupang thus represents a rare case in ceramic studies. Most, if not all, of the pottery was imported to the site and used by the inhabitants of Kaupang but not distributed outside the town itself – again with the possible exception of the Tating jugs.

After the site was abandoned, the pottery proved to be one of the most durable classes of finds. However, post-depositional and archaeological processes have split the pottery into different context-groups and affected the survival rate of the various wares. The most important assemblage derives from the stratified deposits in the Main Research Excavation, 2000–2002 (MRE). Pottery was also recovered during Cultural Research Management excavations, 1999–2003 (CRM), from the later medieval and modern plough-layers above these deposits, and during field surveys. In addition there is the pottery from Blindheim's settlement excavations of 1956–1974 and the cemeteries. This was fully published by Ellen-Karine Hougen in 1993.

This paper explores the pottery assemblage from the fieldwork of 1998–2003 at Kaupang. Emphasis is placed on the assemblage from the stratified deposits in the MRE. The different wares are described, and their value for the chronology of the site addressed. The distribution of the wares in the stratified sequence of the MRE is discussed and certain pottery assemblages from particular contexts in the MRE examined in greater detail. The mechanisms that led to the pottery being transported to Kaupang, used and deposited there are analysed. In other words, this paper addresses the "big three" of pottery studies: "(i) when, (ii) where, and (iii) for what" (Orton et al. 1993:23–4). Technological questions are not discussed here, as they are better treated in connexion with sites of production.

Publishing a ceramic assemblage from a site which has already seen a good, comparatively recent publication, always raises the question "What is new?". Compared with Hougen's publication of the ceramic assemblage from the 1956–1974 excavations, this paper explores a ceramic assemblage recovered from the entire settlement area, not a limited part of the site. The assemblage is more than two-and-a-half times larger than the 1956–1974 assemblage. Part of the 1998–2003 assemblage derives from stratigraphically excavated and water-sieved deposits in a central excavation area, not from a more peripheral part of the site, excavated in spits and without water-sieving.

In addition, this paper benefits from more than fifteen years of intense pottery studies not available to Hougen, who finished her report in 1991. The definition and publication of wares from contemporary northern and central European sites continues at a high rate, and this has led to a more precise definition of the wares found at Kaupang, and thus a more precise estimate of the quantity of the different wares present at the site. At the same time, previously unknown ware-types at Kaupang, such as a red-painted buff ware and possible French white ware are present in the more recent assemblage. These wares were either absent or unrecognized in the 1956–1974 material.

10.1 The current state of research

The study of Viking-period pottery in northern Europe and on the Continent is a vast subject, not to be fully reviewed here. Instead I shall concentrate on ceramic studies dealing with the four early urban sites in Scandinavia and Dorestad, which was the main Continental emporium for Scandinavian Viking-period traders (Ambrosiani 1999b). There are, of course, several further Continental or insular emporia or *wic*s that might be mentioned here, such as *Gipeswic, Lundenwic, Eoforwic/Jorvik* and *Hamwic* in England and *Quentovic* in France. However, as there is no Insular pottery recorded from Kaupang, a comparison with these sites is of little use except in respect of the overall distribution of the various other Continental wares found at Kaupang. The assemblage from *Quentovic* has not been published in detail. An overview of the pottery at these sites has been published by Blackmore (2001).

10.1.1 Kaupang

The Kaupang settlement area had seen only one excavation campaign prior to the 2000–3 excavations. The pottery from the 1956–1974 settlement excavations at Kaupang was published in full by Ellen Karine Hougen in 1993, including a brief description of the small assemblage of pottery from the excavated graves. The assemblage from the settlement area contained 2,021 sherds. The main topics covered in Hougen's publication were trade contacts, the date of the site and the mechanisms of transport. She concluded that activities on the settlement site started in the early 8th century, based on a sherd of a biconical Mayen pot. Hougen identified the main period of settlement as starting in the late 8th century and continuing throughout the 9th. She also pointed out the virtual absence of 10th-century evidence in the settlement material, in contrast to the cemeteries.

Since the pottery in Hougen's publication was recovered by non-stratigraphical excavation she did not address the more precise dating of the excavated deposits or questions of context. Most sherds were recovered from a homogeneous cultural deposit, 20–30 cm thick: the so called "Black Earth" layer – a deposit also encountered during the 2000–3 excavations at Kaupang and found to be a Late-medieval ploughsoil. The composition of her assemblage – 68% Continental wheel-thrown wares, mainly from the Vorgebirge area, 30% softer grey wares, and only a trace of shelly ware – indicates that the deposits may have been largely disturbed, as it corresponds best to what was recovered from the Late-medieval and modern ploughsoils in the MRE. In addition, the light-coloured Vorgebirge wares may have been recovered more fully than other, darker wares during the 1956–1974 excavation, as collection was done by hand, without water-sieving (Pilø 2007:131–3).

10.1.2 Birka

The site of Birka is dated to c. AD 750/780–c. 970. The pottery assemblage from Birka is remarkable because it contains a large number of complete or near-complete vessels from the cemeteries. A total of 750 vessels from the graves are noted by Selling (1955:10). Pottery in the usual fragmented state has also been recovered from the settlement, most recently during the 1991–5 campaign. This excavation was undertaken by the single-context method and with large-scale water-sieving. Around 20,000 sherds were recovered, of which about 25% were imported wares. The most common imports were Slavonic (52%) and Fenno-Baltic wares (36%). The rarer imported West European wares are mainly from the Vorgebirge area and Mayen, besides the unprovenanced Tating Ware (9%) (Blackmore 2001; Bäck 1995).

10.1.3 Hedeby

The town of Hedeby was the largest urban settlement of Viking-period Scandinavia. It was preceded by the so-called Südsiedlung, but the foundation of the town itself probably took place around AD 800 or slightly later, according to the dendrochronological evidence (Schultze 2005). Historical sources describe assaults on the town in 1050 and 1066, after which the site was probably abandoned. Hedeby has seen a series of excavations, most notably Herbert Jankuhn's excavations in the 1960s in the settlement area and Kurt Schietzel's excavations in the harbour of 1979–80. In addition, fieldwalking from 1966–69 led to the collection of a large number of artefacts, including pottery.

The most recent ceramic publication is Walter Janssen's volume on the imported wares (1987). This was preceded by Klaus-Dieter Hahn's 1977 dissertation on the domestic pottery (including the Slavonic wares), Heiko Steuer's work on the pottery of the Südsiedlung and of course Wolfgang Hübener's classic monograph *Die Keramik aus Haithabu* (1959).

The excavations were conducted by digging spits, as a consequence of which the chronological value of the assemblage is limited. The exact size of the assemblage is not given, but Janssen (1987:73–5) states that the 6,401 imported sherds (mainly sherds of Vorgebirge origin and Tating Ware) constitute c. 7% of the total assemblage, which would then be around 90,000 sherds (including the 1979–80 harbour excavations). However, Hahn (1977:8) gives the total number of sherds from excavations prior to 1970 at 117,283. Whichever figure is correct, the Hedeby ceramic collection is by far the largest from a Scandinavian Viking-period town.

10.1.4 Ribe

Ribe was founded in the early 8th century as a seasonal market place, and developed into a permanent settlement in the later part of this century (Feveile 2006). Most of the Viking-period deposits which have been excavated in Ribe so far are of 8th- and early 9th-century date. Thus the artefactual assemblage from Ribe is somewhat earlier than that from the other Viking-period urban sites.

The 8th- and 9th-century pottery from the 1970–76 excavations at Ribe was published by Hans Jørgen Madsen in 2004. This assemblage contains c. 7,250 sherds, of which 433 are imported. Among the imports, Slavonic wares amount to only 14 identified sherds (0.3% of the imported wares), *Muschelgrus* ware 104 sherds (24.0%) and "Badorf Ware" 166 sherds (38.3%). 22 sherds are said to be Tating Ware (5.0%), and 2 sherds are suspected of being Mayen in origin (Madsen 2004:252–7). Of special interest is the local production of a coarse, wheel-thrown pottery (Feveile et al. 1998).

The pottery from the 1985–6 Nicolaigade 8 excavation is described by Frandsen (1989). An overview of the pottery from more recent excavations has not yet been produced.

10.1.5 Dorestad

This site was established c. AD 675, and ended its existence shortly after the last recorded Viking raid on the site in AD 863 (van Es and Verwers 1980:294–9).

The main excavations in Dorestad took place from 1967 to 1976. The most important site was

Hoogstraat I, which was excavated in 1972. The pottery from this excavation was published by Wip van Es and W. J. H. Verwers in 1980. The pottery was grouped by date, fabric-type and method of production (wheel-thrown or hand-made). The total size of the pottery assemblage is estimated at 45,000 sherds, including up to 25,000 rims (van Es and Verwers 1993:227 and 232). The pottery from the Hoogstraat I excavation amounts to c. 22,000 sherds, most of which are of 7th-, 8th- and 9th-century origin (van Es and Verwers 1980:134). Vorgebirge and Mayen ware, together with local handmade coarse wares (shelly ware and grey ware) are the most common types.

10.2 The pottery from the fieldwork 1998–2003: an overview

Northern Europe saw large-scale production and distribution of pottery during the Viking Age. However, the character of the products varied widely according to the level of organization of production, the vessel-types produced, and the raw materials available. In addition, some wares, such as the Vorgebirge wares, achieved widespread distribution, while other wares, such as the wheel-thrown grey ware from Ribe, are hardly found outside their area of production.

The overall artefact assemblage from Kaupang reveals that traders from the site were in contact with most parts of northern Europe throughout the life-span of the settlement (c. AD 800–960/980). The presence of Frankish dress accessories suggests the presence of actual Frankish merchants in the town (Wamers, this vol. Ch. 4:78–9, 89–90; Skre, this vol. Chs. 15:402–3, 411–12, 16:431–4). Insular decorative metalwork points to contacts with Britain and Ireland (Wamers, this vol. Ch. 4:80–7, 92–7; Graham-Campbell, this vol. Ch. 5; Skre, this vol. Ch. 16:440). Coins and weights indicate an eastern contact zone (Blackburn 2008; Kilger 2008a, 2008b; Pedersen 2008; Skre, this vol. Ch. 16:439–40), as do the beads (Wiker, in prep.).

It would be natural to expect the pottery assemblage to more or less mirror this picture, but this is not the case. Only selected Continental wares are present – Vorgebirge wares, Mayen wares and possible French white wares – but Continental wares from the very late 9th and 10th century are absent: there is no Hunneschans pottery or post-Carolingian Pingsdorf-type Ware, even though the site was permanently occupied at the time of production of these wares. No pottery from Britain or Ireland has yet been recovered from the site either, even though the decorative metalwork shows continuous contact with these areas throughout the life-span of the settlement.

In addition, but harder to ascertain due to the fragmented state of the pottery, the types of pottery vessels which arrived at Kaupang were probably only a limited range of the large array of different types found on the Continental sites and elsewhere.

Fieldwork	Sherd count	%	Weight	%
MRE	3,434	64.7	23,741.2g	66.9
CRM	1,644	31.0	10,316.5g	29.1
Field surveys	231	4.4	1,424.5g	4.0
Total	5,309	100.1	35,482.2g	100.0

Table 10.1 *Pottery collected from the excavations and surveys.*

10.2.1 The method of collection

The pottery has been collected in two different ways: during excavation and surveys (Tab. 10.1). The vast majority of the pottery has been collected from excavated deposits which have been water-sieved through a 5-mm mesh. Some of the pottery derives from CRM excavations where the circumstances allowed only for collection by hand. Only a small percentage derives from the field surveys.

The ceramic assemblage from the intact deposits in the MRE, which is the main focus of this presentation, has been meticulously collected. The contexts from which this pottery derives were excavated in single contexts, and nearly all the deposits were water-sieved. Thus this assemblage probably represents the near total collection of the pottery present in the intact deposits at the time of excavation.

Collection during field survey and, to a lesser degree, collection by hand during CRM excavations tends to bias the evidence towards larger sherds of colours which stand out against the colour of the soil. The classic example of this is the whitish Badorf Ware, which is much easier to see than a coarse, reduced grey ware against the dark grey of the ploughsoil at Kaupang. This factor does not bias the pottery assemblage recovered by water-sieving.

10.2.2 Site-formation processes

The pottery is highly fragmented, with average sherd-weights of c. 8 g in the stratified deposits in the MRE and c. 7 g when all deposits in the MRE are considered including the ploughsoils. The average sherd-weight in the total collection is c. 6 g. In essence this means that most of the sherds have been fragmented down to the point where either they stabilize because of the thickness of the sherds com-

Ware	Intact deposits				Ploughsoils			
	Count	%	Weight	%	Count	%	Weight	%
Continental wheel-thrown wares	441	25.6	3,356.9	24.0	693	40.5	3,399.0	35.5
Grey ware	1,121	64.9	9,736.2	69.5	930	54.4	5,795.2	60.5
Shelly ware	140	8.1	684.8	4.9	37	2.2	159.6	1.7
Other wares	22	1.3	237.1	1.7	51	3.0	226.7	2.4
Sum	1,726	99.9	14,015.0	100.1	1,711	100.1	9,580.5	100.1

Table 10.2 *The composition of the Viking-period pottery assemblage from the MRE according to context. Pottery from cleaning layers or other contexts not related to intact, stratified deposits or ploughsoil is not included.*

pared to their size or they disintegrate. As the sherd-weight is only slightly higher in the stratified deposits, it can be inferred that most of the destruction process connected with the pottery after the initial breakage took place already during the life-span of the settlement, probably mainly by trampling.

Even though pottery is very durable as a rule, there are a number of factors that influence the survival rates of various kinds of pottery in the archaeological record. For the moment I shall by-pass how different functions of the pottery result in different breakage rates during the pottery's period of use. Instead I will concentrate on the post-depositional factors that influence the evidence.

Since the abandonment of the site a number of processes have influenced the ceramic record. The main factor is the agricultural activity that has taken place at Kaupang since the 15th century. The deposits from the more recent phases of the Viking-period settlement have been destroyed by ploughing. Even though the settlement lasted from c. AD 800 to AD 960/980, the preserved stratified deposits are mainly from ca. AD 800 to AD 850. 10th-century deposits have only been found as yet in the harbour sediments, but those excavated in 2003 did not contain any pottery.

Once in the ploughsoil, the pottery has been subject to abrasion and breakage, which has altered the pottery assemblage here compared with that in the stratified deposits. Hard-fired, fine-tempered, good-quality wares have a higher survival rate in the ploughsoil, as is clearly shown by the higher percentage of these wares from the Vorgebirge area of the Rhineland (Continental wheel-thrown wares) than shelly and grey wares, compared with the stratified deposits (Tab. 10.2).

The digging of drainage ditches from the 19th century and onwards has also led to the removal of deposits from the levels of the intact, stratified deposits. Thus it is not only the more recent deposits that have been destroyed by ploughing; even the levels below the ploughsoil have been adversely affected by agricultural activities. In some areas there are no longer any preserved stratified deposits.

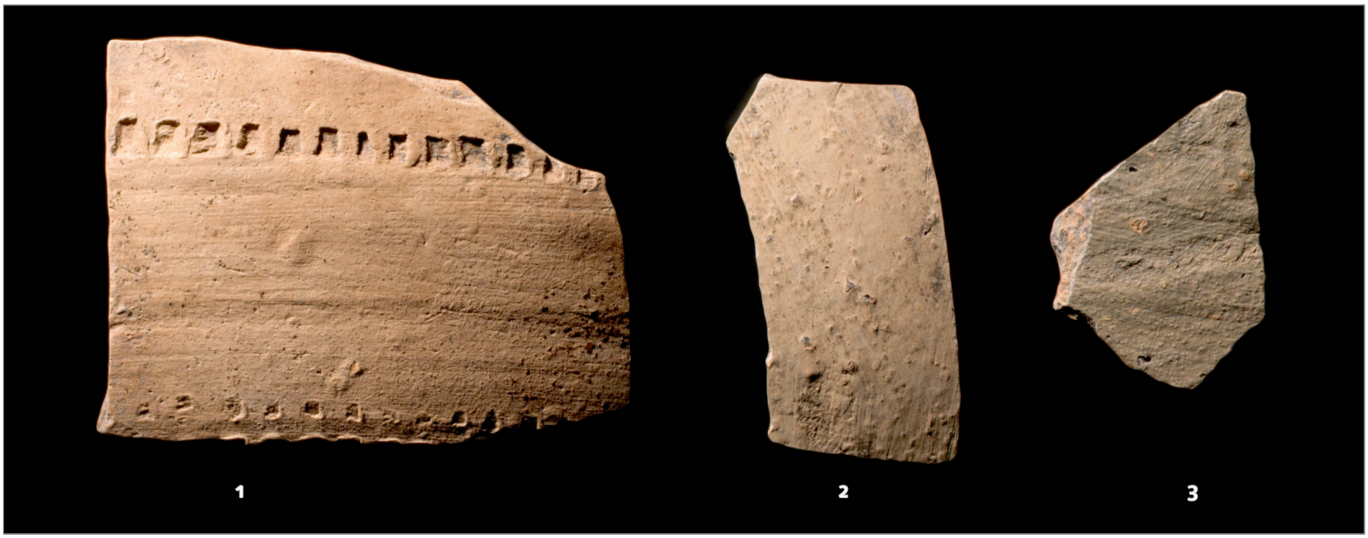
10.2.3 The method of analysis

The pottery has been analysed by weight and sherd-count, as shown in Tables 10.1 and 10.2. Other types of counting, such as *numbers of vessels represented* or *vessel-equivalents*, are difficult to implement because of the highly fragmented state of the pottery (see Orton et al. 1993:21–2 and 166–81 for a presentation and discussion of problems with quantification). Each sherd is counted, even if it fits with another sherd from the same context.

The sherds have been sorted into find-units based on context and ware. In practice this means that the pottery from any one context has been divided into as many find-units as there are wares present. The coarse grey wares were normally not subdivided, with one exception. The fabrics of the coarse grey wares from the stratified deposits in the MRE were described in detail during the find examination. Sherds of coarse grey wares from the same context which did not agree in fabric-description were separated into individual finds-units.

Thin-section analysis and Inductively Coupled Plasma Spectroscopy (ICPS) has been undertaken on a selection of sherds by Alan Vince. The objectives were three:

- To check the origin of the pottery in one of the earliest contexts in the MRE.
- To trace the origin of wares that are not immediately identifiable.
- To check if the grouping of sherds of grey wares based on the visual analysis of the fabrics was sustainable.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The results of this analysis are published separately (Vince, this vol. Ch. 11).

10.3 Wares and contexts

The pottery from the stratified deposits in the MRE is qualitatively the best pottery assemblage so far from Kaupang. The stratified deposits are dated to c. AD 800–840/850 (Pilø 2007:185) – quite a narrow time-frame. These deposits were excavated in *single contexts* and the excavated soil was water-sieved. The ceramic assemblage from the stratified deposits in the MRE amounts to 1,726 sherds, of which 198 are rim sherds. The total weight is 14,192 g.

Due to the highly fragmented state of the material, the identification of the sherds often does not go beyond the wares. Sometimes special pot-shapes can be identified, such as *Reliefbandamphorae* from the Vorgebirge area, as their rims and ornamental bands are diagnostic even in small fragments.

In what follows, the definitive features of the different wares are described and their presence at Kaupang is quantified. Typical examples are presented in drawings and photographs. Their overall distribution is reviewed, and the character of their presence at Kaupang discussed.

10.3.1 Vorgebirge wares

In non-specialist literature the Vorgebirge wares are often commonly referred to as "Badorf pottery", but this over-simplified concept covers a series of slightly different wares from a small area close to the Rhine near Bonn, Germany, produced in the neighbouring villages of Walberberg, Eckdorf, Badorf and Pingsdorf. These wares are high-quality, wheel-thrown pottery produced on an industrial scale. A large number of different vessels were produced, of which the *Kugeltopf* and the *Reliefbandamphora* (Giertz 2000) were the most common. The use of "Badorf Ware" as a general term for pre-10th-century wares from the Vorgebirge area should be avoided. The term used here for these wares from the period 700–1300 is "Vorgebirge wares".

The Vorgebirge wares are found at Dorestad (van Es and Verwers 1980:56–160) and a number of coastal sites (Sanke 2001). They have also been found on English sites (Blackmore 2001:31–2), and at Scandinavian sites such as Ribe, Hedeby and Birka. The most common exports were vessels of the Badorf-type Ware (c. AD 750–900) and Pingsdorf-type Ware (c. AD 900–1300).

Several of the Vorgebirge wares reached Kaupang, and were described in Hougen's publication. Amongst the Vorgebirge pottery from the 1998–2003 fieldwork there is pottery of Badorf-type Ware, Walberberg-type Ware and Carolingian Pingsdorf-type Ware. A total of 10,794.3 g of Vorgebirge pottery has been recovered, consisting of 1,898 sherds, which is c. 30.4% of the whole pottery assemblage by weight and c. 36% by sherd count. Of this, 3,227.9 g, in 411 sherds, is from stratified contexts in the MRE – a significantly lower proportion of the total, 23% by weight and 24% by sherd count. This is a product of the differential preservation of the various wares in disturbed contexts.

It is possible to divide the Vorgebirge pottery into several types based on the fabric. However, it may be confusing for the name of the villages to be included in the ware names, as the production in some of these villages included wares named after a neighbouring village – e.g. so-called "Badorf pottery" produced in Pingsdorf. On the other hand it would be foolhardy to introduce a new terminology for the Vorgebirge pottery based on a peripheral site like Kaupang. For this reason I have chosen to use the terms Badorf-type Ware, Walberberg-type Ware and Carolingian Pingsdorf-type Ware, and have defined the criteria used to classify the pottery within these groups. *Reliefbandamphorae* are often separated from the other Vorgebirge pottery, but this is really just a special type of vessel produced in the

Figure 10.1 *Close-ups of fabrics of: **1:** Badorf-type Ware (C52519/21890), **2:** Walberberg-type Ware (C52519/22872), **3:** Carolingian Pingsdorf-type Ware (C52519/10113). (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.*

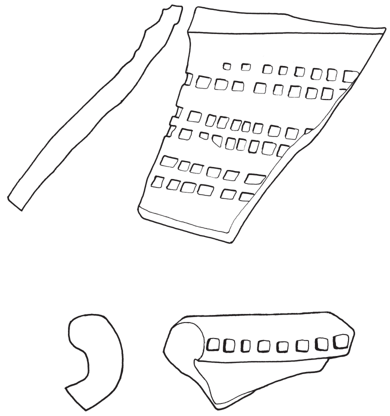


Figure 10.2 *Badorf-type Ware from stratified deposits in the MRE. **1:** Dorestad W IIC, class y pitcher (C52519/21115); **2:** Kugeltopf (C52519/17242). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

various types of Vorgebirge ware. For this reason the sherds from *Reliefbandamphorae* are included under the individual wares.

Badorf-type Ware

Badorf-type Ware (Fig. 10.1.1) is a wheel-thrown, fine sandy ware. The inclusions range in size from 0.1–0.3 mm. The external colour is normally in the range of white to beige but may range from yellow and orange to grey. A large array of different vessel-types was produced, but the most typical found at Dorestad was a rather, large, thinly walled, egg-shaped vessel with a lenticular base and rouletted decoration on the upper part of the vessel (van Es and Verwers 1980). Another common vessel-type is the large *Reliefbandamphora* with applied strips. Badorf-type Ware dates from the first quarter of the 8th century to the end of the 9th, when it was supplemented by Hunneschans pottery (which is really just a red-painted version of Badorf-type Ware), and superseded c. AD 900 by Pingsdorf-type Ware (Sanke 2001:286–301).

Most of the Vorgebirge pottery recovered from the intact stratified deposits in MRE is Badorf-type Ware – 284 sherds, weighing 2,185.4 g. Only five of these are rim sherds. The thickness of the sherds averages 4–6 mm.

Table 10.3 shows some recurrent features of the distribution of pottery in the MRE. The presence of Continental fine-wares only on plot 2A and 2B in SP I is a regular feature, and raises a suspicion that the stratigraphy in this bit of the site may have been misread. This suspicion is reinforced by the early occurrence of other classes of artefact on this plot, such as loomweights (Øye, this vol. Ch. 13:361, 365) and sherds of glass (Gaut, this vol. Ch. 9:201). Plots 2A and 2B were the least well preserved part of the excavation area, where stratification could only be followed with great difficulty. Thus we should not attach much weight to the presence of Badorf-type Ware in SP I. It may be that this ware was imported to the site only after the initial seasonal settlement of SP I.

Two types of vessel can be identified in the stratified deposits (Fig. 10.2). Three rim sherds can be identified as belonging to Dorestad W IIC, class y pitchers (van Es and Verwers 1980:74–6; Fig. 10.2.1), but otherwise the low number of rim sherds in the assemblage makes the identification of further types impossible. 34 sherds have rouletted rectangles as decoration, normally in a double row, but sometimes in a single or triple row.

More easily identifiable are the *Reliefbandamphorae* because of their *Reliefbänder* (raised strips) and diagnostic rims. 35 body sherds can be identified in the assemblage (Fig. 10.3), but no rims are present.

Context	Sum	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3A	Plot 3B	Other
SP I	26/269.5 g			6/104.3 g	20/165.2 g			
SP II	119/1,022.0 g	29/158.1 g	5/76. 4 g	21/83.5	32/435.6 g	13/65 g	11/150.3 g	8/53.1 g
SP III	30/132							
SP I–III	109/761.9							

Table 10.3 *The distribution of Badorf-type Ware in the stratigraphic sequence of the MRE: sherd-count/weight. The "Other"-group is mainly from contexts in the plot-divisions which cannot be related to individual plots or Site Periods.*

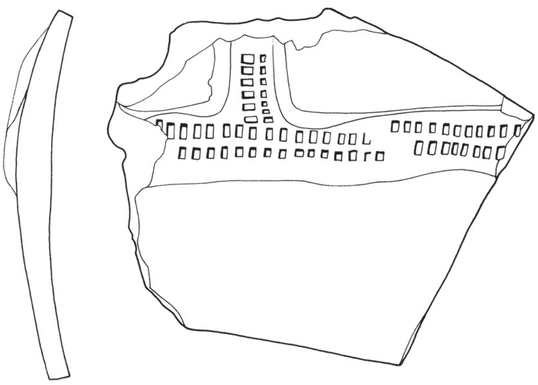


Figure 10.3 *Badorf-type Ware,* Reliefbandamphora *body sherd (C52519/16597) from a stratified context in the MRE. (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 10.4 *Badorf-type Ware,* Reliefbandamphorae, *from stratified deposits in the MRE, with cooking residue on the inside (lower) (C52519/27398). (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.*

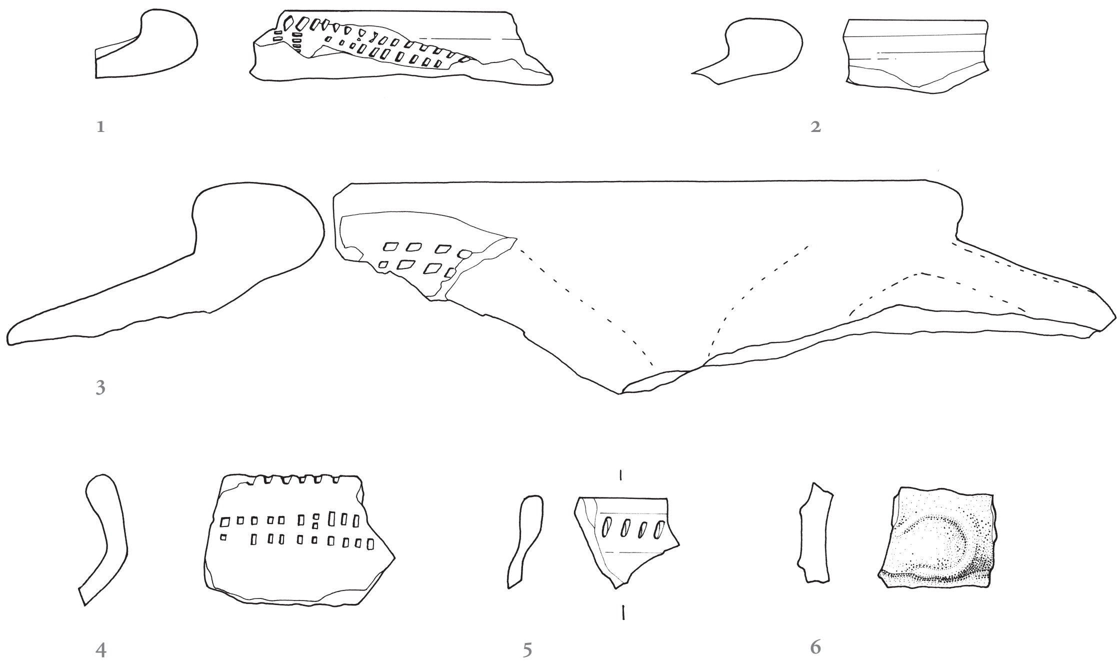
Figure 10.5 *Badorf-type Ware. Rim sherds of* ***1–3:*** Reliefbandamphorae *(C52519/9901, 10548, C52516/1827) and* ***4–5:*** *Dorestad type WIIC, class y pitchers (C52519/9960, C52264/1114), recovered from unstratified contexts outside the MRE.* ***6:*** *Sherd from* Reliefbandamphora *with thumb imprint on the strip (C52264/904). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Since the lower half of the *Reliefbandamphorae* had no bands, many of the non-decorated body and base sherds of Badorf-type Ware may derive from this type of vessel.

Because of the lack of rims it is hard to assign the sherds to specific vessel-types in Giertz's typology (Giertz 2000). However, it is chronologically important that all the raised strips are decorated with rouletted rectangles, normally in two rows, but sometimes in one or three rows (Fig. 10.3). Non-decorated, thumb-imprinted or stamped decorated raised strips of Badorf-type Ware, which would have indicated an 8th-century date, are not present in the stratified deposits.

Rather surprisingly, a few of the *Reliefbandamphorae* sherds have a residue on the inside of the vessels that suggests they are from amphorae which were used for cooking (Fig. 10.4). This was surely not the original function of the amphorae, but more likely an ad hoc, pragmatic use at Kaupang.

In the remaining unstratified assemblage from the 1998–2002 fieldwork, 1,296 sherds, weighing 6,077.9 g, are of Badorf-type Ware. 151 sherds can be identified as belonging to *Reliefbandamphorae*, but only six are rim sherds (Fig. 10.5). Four of the rim sherds can be identified as Gierz's types 6, 6/8 and 8/9 (Fig. 10.5.1–3), but the others cannot be classified. When decorated, the decoration was normally rouletted rectangles, mostly in double rows. The exception is a single sherd with thumb imprints on the raised strip (Fig. 10.5.6 – collected during field survey). Raised strips with thumb imprints are normally considered to be an 8th-century phenomenon



(Giertz 2000:236–40).

There are four examples of sherds of Badorf-type Ware of Dorestad type WIIC, class y pitchers in the remaining unstratified assemblage (Fig. 10.5.4–5). When decorated, the decoration is invariably rouletted rectangles, mostly in double rows. Eight sherds show combing, which is believed to be a feature of the second half of the 9th century (Giertz, pers. comm.)

Walberberg-type Ware

Walberberg-type Ware (Fig. 10.1.2) is named after pottery recovered in the village of Walberberg, close by the village of Badorf. Walberberg-type Ware is a wheel-thrown sandy ware. The inclusions range from 0.4–0.6 mm. A characteristic difference from Badorf-type Ware is the presence of rounded inclusions in the order of 1–2 mm in size. Following the drying and firing of the pottery these larger inclusions produce a rougher surface than with Badorf-type Ware. The colours vary from yellow to orange-brown, but may also be grey due to reduction (Sanke 2001:276–7). Pottery was produced at Walberberg from around AD 500, much earlier than at Badorf (Giertz 2004:290). However, the ware that reached Kaupang was produced from the mid-8th century to c. AD 860/870, when production at Walberberg apparently decreased steeply. Later wares such as Pingsdorf-type Ware were then produced in the villages further north (Sanke 2001:280).

Walberberg-type Ware has been recovered from stratified layers in the MRE: 81 sherds, weighing 878 g (Tab. 10.4). No rim sherds were recovered. The thickness of the body sherds is mostly 4–5 mm.

Fifteen of the Walberberg-type sherds are from *Reliefbandamphorae*, and two sherds can be shown to belong to specific types defined by Giertz: both type 5, by the diagnostic placing of the raised strips on the body of the amphorae. Remarkably, a few of the *Reliefbandamphora* sherds show clear signs of sooting produced by cooking, indicating the ad hoc use of at least one *Reliefbandamphora* for cooking.

Context	Sum	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3A	Plot 3B	Other
SP I	2/16.9 g	1/10 g		1/6.9 g				
SP II	32/373.1 g	2/3.9 g		1/1.1 g		1/0.7 g	27/361 g	1/6.4 g
SP III	24/174.7 g							
SP I–III	23/313.3 g							

Table 10.4 *The distribution of Walberberg-type Ware in the stratigraphic sequence: sherd-count/weight. The "Other"-group is mainly from plot-divisions.*

Figure 10.9 *A single sherd of* Merowingische rauhwandige Ware *(C52516/5548). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM.*

Figure 10.6 *Walberberg-type sherd (C52519/27506) from a stratified deposit in the MRE that is very similar to material from the Walberberg Buschgasse kilns. (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.*

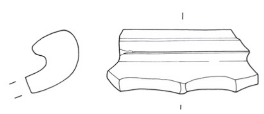


Figure 10.7 *Rim sherd in Walberberg-type Ware of Reliefbandamphora of Giertz type 6, from a stratified deposit in the MRE (C52519/13224). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

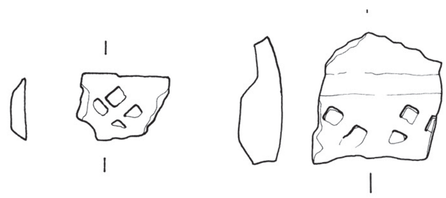


Figure 10.8 *Sherds of* Reliefbandamphorae *in Walberberg-type Ware with cross stamps on the strips (1–2: C52264/503, 674). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

About 20 sherds are very closely similar to Walberberg Buschgasse reference sherds (personal inspection by Wolfram Giertz, 12 February 2007), and may well have been produced in those kilns (Fig. 10.6).

In the rest of the collection from the 1998–2002 fieldwork, 153 sherds, weighing 1,494.8 g, are of Walberberg-type Ware. 21 of these sherds can be identified as belonging to *Reliefbandamphorae*, but only three are rim sherds (one of Giertz type 6: Fig. 10.7). When decorated, the decoration is normally rouletted rectangles, mostly in double rows. Sherds with a very close resemblance to Walberberg Buschgasse kiln material were also identified here by personal inspection, and even two sherds resembling Walberberg Kitzburgerstrasse kiln material: in both cases reference sherds were used.

In case of the Walberberg-type Ware, three sherds were recovered that pre-date the start of the site c. AD 800 (Fig. 10.8). Two sherds of *Reliefbandamphorae* (one body sherd and one loose strip) have cross stamps instead of the usual double rows of rouletted rectangles. Both were collected by fieldwalking. Raised strips with cross stamps are normally considered to be an 8th-century phenomenon.

One small sherd is not of the usual Walberberg-type Ware but of a typically 7th-century fabric known as *Merowingische rauhwandige Ware* (Fig. 10.9), with dense sand tempering, dark grey with a reddish surface (Giertz, pers. comm.). This sherd was recovered from pit A9422, from an unstratified fill. This is a much later context, certainly no earlier than the 9th century.

Figure 10.10 *A rim sherd of Carolingian Pingsdorf-type Ware (C52516/1020). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

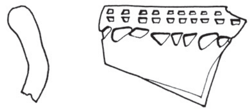
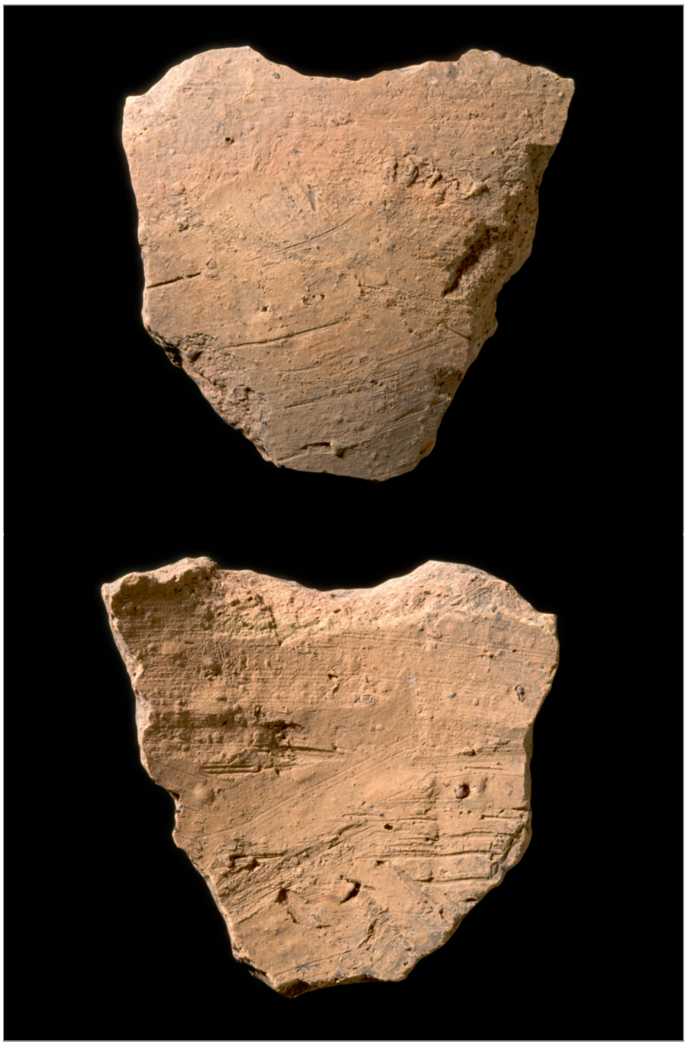


Figure 10.11 *Mayen-ware sherd from a stratified deposit in the MRE (C52519/10899). (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.*

Figure 10.12 *Tating Ware (C52516/2782). (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.*



Carolingian Pingsdorf-type Ware

Carolingian Pingsdorf-type Ware (Figs. 10.1.3, 10.10) was distinguished from the other Vorgebirge wares by Markus Sanke (1999:253–4). This is a hard-fired greyish ware with coarser inclusions than the Badorf-type Ware. The pottery often has a lighter coloured core. The Carolingian Pingsdorf-type Ware is a precursor to the classic 10th-century red-painted Pingsdorf-type Ware. It is generally believed to belong mainly to the second half of the 9th century.

Sixteen sherds, with a total weight of 88.8 g, were recovered during fieldwork. This amount is so small that a detailed examination of context is not meaningful. Four of these sherds derive from intact stratified deposits, two of which can be dated to SP II in the MRE. This context is a little earlier than would be expected from the Continental dating, but the sherds are small (less than 10 g each) and may be intrusive.

Possible Vorgebirge pottery

In addition, pottery which is believed to be of a Vorgebirge origin, or at least of possible Vorgebirge origin, but which does not fall clearly into any of the above groups, is simply grouped under the heading of Vorgebirge wares. This constitutes a total of 87 sherds weighing 361.8 g.

10.3.2 Mayen wares

The pottery-producing town of Mayen was situated close to the Vorgebirge area but had a much longer history of pottery production, going back into the Roman Period. A series of different wares were produced at Mayen from the Roman Period

Figure 10.13 *Greyish-brown sherds with corroded applied tin foil (C52519/25459). (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.*

Figure 10.14 *Sherds from a costrel in orange-painted buff ware (C52516/5586, C52519/10492, /11859, /12558, /17606, /20376, /28936, /28996). (Scale 1:2) Photo, Eirik Irgens Johnsen, KHM.*

Figure 10.15 *A costrel from Dorestad kept in Leiden, National Museum of Antiquities (inv.no. WD70-8492). Photo, RMO/Peter Jan Bomhof.*

onwards, several of which became widely distributed (Redknap 1999). A total of 5 sherds weighing 43 g are identified as Mayen wares but cannot be precisely dated (Fig. 10.11). One of the sherds was recovered from a SP II deposit in the MRE. The other four are from unstratified deposits.

10.3.3 Tating Ware, black-burnished ware, and sherds with tin foil

Tating Ware is one of the most intensely discussed wares of the Viking Age (Stilke 2001b). The artistically striking black-burnished jugs, with applied tin foil forming geometrical patterns, were sought-after items at that time. They achieved a widespread distribution, from England in the West, to Borg in Lofoten in the North and Staraja Ladoga in the East.

Even with geochemical analysis, it has not been possible to pin-point the production site or sites of the Tating Ware. The place of origin is believed to be somewhere in the area of the Middle Rhine, the Maas or northern France (Stilke 2001:267). Tating Ware was produced from the mid-8th century at least until the mid-9th (Stilke 2001b:265–6).

In contrast to the other wares, Tating Ware has been found in Norway at other sities besides Kaupang, highlighting its different role in trade from that of the other wares. A Tating-ware sherd (with tin foil) has been recovered from the hall platform at Huseby, Tjølling, a kilometre from Kaupang as the crow flies (Skre 2007e:234–5). Tating Ware has also been recovered from Borg in Lofoten (Holand 2003b: two pitchers, both with tin foil, but only one black-burnished); from a grave at Huseby, Sandar, Vestfold, not far from Kaupang (C30851; Hougen 1993:8: a fragment of handle, found in a field); and from Gimmen, Idd, Østfold (C15867; Hougen 1960:95–6: greyish-brown pitcher sherds with remains of tin foil).

What is termed Tating Ware in the literature is not always well-defined, however. In this paper, the term Tating Ware is restricted to black-burnished ware with applied tin foil. Sherds of a similar ware without the tinfoil are termed black-burnished ware. In addition, there is small group of sherds of a wheel-thrown grey-brown ware with applied tin foil.

Tating Ware, as just defined, is represented by 30 sherds weighing 192 g in total (Fig. 10.12). Four sherds were collected from stratified deposits in the MRE, none earlier than SP II. One sherd is from SP III. Due to the unfavourable conditions for preservation and the small size of the sherds, the shape of the tin-foil decoration is often indiscernible. However, in a few cases triangles and lines can be seen.

Black-burnished sherds without applied tin foil number 54, weighing 251.4 g. Included in this group are four sherds from the fieldwalking which are alike in fabric to the black-burnished sherds but are so worn that including them in the same category is a little dicey. 13 sherds, weighing 48.2 g, are from stratified deposits in the MRE. The six sherds that can be related to specific Site Periods were recovered from deposits belonging to SP II.

The greyish-brown sherds with applied tin foil (Fig. 10.13) number 14, weighing 82.7 g. Included in this group are three sherds of a closely similar fabric but with no preserved, applied tin foil. All of these sherds were recovered on plots 3A or 3B or were associated with the plot-division ditch A63192 north of these plots. The sherds are thus most likely from a single vessel, even though they had become scattered in deposits from different Site Periods. None of these deposits, however, is of SP I.

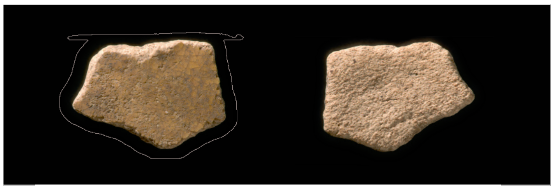
10.3.4 Other Continental wares

A number of sherds are of wares which may be of Continental origin. Most have been collected from unstratified deposits, and some may be of more recent date. This is hard to tell, however, as the many of the sherds are worn.

Orange-painted buff ware

Among this group of sherds, a few stand out and merit more detailed discussion. Nine sherds (85.7 g) are of buff ware (Fig. 10.14), and eight of these nine are painted orange. The combination of the orange paint and concentric wheel marks not going around the body of the vessel but centered on the body (see Figs. 10.14–15) makes it highly likely that these sherds constitute the remains of a Zelzate-like costrel (van Es and Verwers 1975:pls. XVII–XVIII). This appears to be the first time that a costrel of this kind has been found on a Scandinavian site, although the type is known from Dorestad (Fig. 10.15; van Es and Verwers 1975:141–5, fig. 3).

One sherd lacks the orange paint, but the fabric is very similar and the characteristic wheel-marks show that it is most likely from a costrel. It is possible, even likely, that there are more sherds from this costrel in the collection, but this ware is very similar to Badorf-type Ware, and thus impossible to distinguish in the absence of the orange paint or the characteristic wheel-marks. The place of origin of these vessels is not known, but ICPS analysis of one of these sherds by Alan Vince (C52519/11859: this vol.



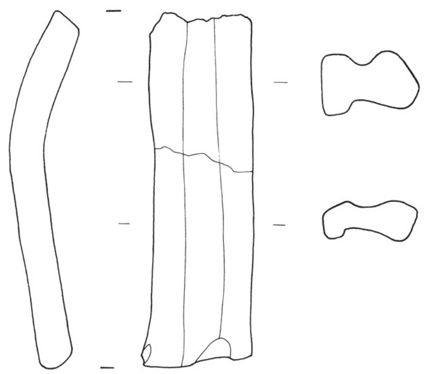


Figure 10.16 *A sherd of glazed Huy-type ware (C52264/527), left: outside; right: inside. (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM.*

Figure 10.17 *A handle, in two pieces, thought to be of French white ware (C52519/12183, 17174). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 10.18 *Four sherds of an unidentified sandy ware with rouletting (C53516/668, C52519/11261, 12446, 17195). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM.*

Ch. 11:309) has shown that the costrel ware matches the fabric of the Vorgebirge wares. A similar area of origin can be conjectured.

Only one of the sherds is from a stratified deposit, from the sandy fill in the passage between plots 1A and 2A of SP II. The limited distribution of the sherds suggests that they are from one vessel.

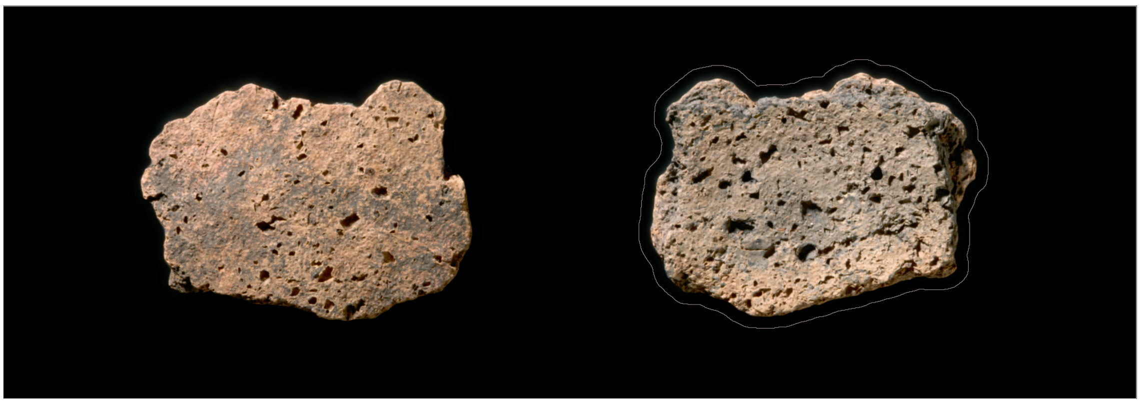
Huy-type ware

A single sherd of a ware matching Huy-type ware, Giertz's fabric 9c (1996:64), with yellow, finely crackled glaze, was collected during field survey work (Fig. 10.16). This ware can be dated to the third quarter of the 9th century (Giertz, pers. comm.). This is the first possible find of Huy-type ware from Scandinavia, and it would have been desirable to have it checked by geochemical analysis. Due to its small size, however, this would have meant the destruction of the sherd, and for this reason further analysis has been suspended for now.

French white ware?

Three sherds of Continental white ware are of diagnostic shapes that show they are not of a Vorgebirge origin. Two pieces of a long handle (C52519/12183, 17174; Fig. 10.17) are suspected to be of French origin, possibly from La Londe or Beauvais in north-

Figure 10.19 *Body sherd of shelly ware, with cavities, from a stratified deposit in the MRE (C52519/24788). (Scale 1:1). Photo, Eirik Irgens Johnsen, KHM.*



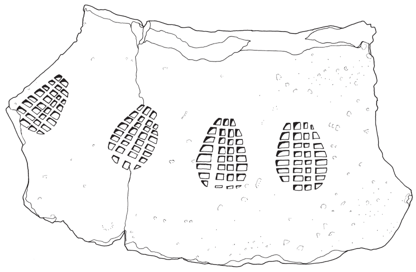


Figure 10.20 *Rim sherd of shelly ware from a stratified deposit in the MRE (C52519/28798). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

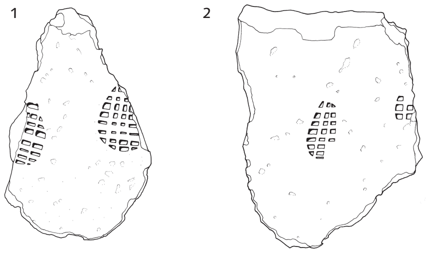


Figure 10.21 *Stamped decoration on shelly ware from stratified deposits in the MRE (**1:** C52519/19485, **2:** C52519/28354). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

ern France. One sherd appears to be the base of a spout, of a type much like those on the costrels (C52519/10977).

One sherd has what appears to be a red wash, which may be of the *Peinte et poli* type that was possibly produced in the Paris basin (C52519/38484). Another has incised decoration consisting of wavy lines (C52529/12376).

Several other sherds in a similar fabric, but lacking diagnostic shapes, were separated from the Vorgebirge wares during the examination of the finds, but an ICPS analysis of one of these sherds (C52517/1311) proved it to be of a Vorgebirge origin (Vince, this vol. Ch. 11). The sherd sampled, and possibly the others lacking without diagnostic shapes, may be of a Vorgebirge origin, but of an uncharacteristic fabric. Thus the identification of further sherds of French wares on the basis of fabric rather than diagnostic shape proved hazardous. Neither the more diagnostically shaped sherds nor those in a similar fabric were found in stratified contexts.

It can therefore be stated that French white wares may be present in the Kaupang assemblage, but, if so, only as a very minor part of the Continental material.

Sandy ware with rouletting

Four sherds of a greyish sandy ware with rouletting have been recovered (Fig. 10.18). The origin of the sherds is not known. All four sherds are from unstratified deposits.

10.3.5 Shelly ware

Shelly ware, *Muschelgrusware* as it is called in the German literature, was produced both in the costal areas of Frisia and in England during the Viking Age (Stilke 2001a). Frisian shelly ware was distributed along the coastline both to the north and the south of Frisia and is present both at Dorestad and Ribe. It was produced from AD 770/780 into the 10th century (Stilke 2001a:197).

This ware is characterized by the use of seashell as temper, either as part of the original matrix or as added inclusions. Depending on the acidity of the context in which the pottery has lain after deposition, the shell may be preserved or have leached out leaving cavities in the fabric (Stilke 2001a:175). The latter is the case at Kaupang (Fig. 10.19). In addition to shell, shelly wares may contain sand and other inclusions.

Frisian shelly ware was shaped by hand, not wheel-thrown like the Continental wares just described. It was probably fired on open fires, not in a kiln (Stilke 2001a:192–3).

Most of the shelly wares recovered from the Frisian zone and Jutland are believed to be of Frisian

Context	Sum	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3A	Plot 3B	Other
SP I	46/158.2 g	1/13.3 g		40/125.6 g				5/19.3 g
SP II	81/395.6 g	1/2.9 g		16/50.7 g	2/4.6 g	20/59.1 g	25/217.5 g	17/60.8 g
SP III	4/21.4 g							
SP I–III	9/109.6 g							

Table 10.5 *The distribution of shelly ware in the stratigraphic sequence of the MRE: sherd-count/weight. The "Other"-group is mainly from plot-divisions.*

origin. It has been argued, however, that a few sherds from the Ribe assemblage were of English origin (Stilke 2001a:204–5). The sherds of shelly ware from Kaupang are generally very small, and it is hard to say anything definite about their place of origin. About 35 rim sherds can confidently be identified as Frisian shelly ware from their diagnostic shape (Fig. 10.20), as can two body sherds with stamped grid decoration (Fig. 10.21). No sherds of English origin have been identified.

A total of 140 sherds, weighing 684.8 g, has been recovered from stratified deposits in the MRE. The thickness of these sherds is usually 5–8 mm.

As Table 10.5 shows clearly, shelly ware is present throughout the stratigraphic sequence. Once again, though, its presence in SP I is strongly dependent upon plot 2A, a plot with problematic stratigraphy and the probable disturbance of SP I. The five sherds in the "Other"-group in Table 10.5 are from the ditch between plots 2A and 2B. It may well be that the shelly ware only became conspicuous at Kaupang in SP II, together with the Continental wheel-thrown wares.

Even though the globular pots in shelly ware are reported primarily to be cooking pots, remarkably few sherds (4) have any preserved residue on the inside – a much lower frequency than in the case of the grey ware, presumed to have had a similar function. The reason for this is unclear. The pots may have been brought to Kaupang for some other purpose, for instance as containers under transport. There is no reason why a cooking residue should not stick to the exterior of the shelly wares because of the nature of the fabric, as shelly ware with encrusted carbon and burnt food residues is well known from England (Vince, pers. comm.).

A total of 199 sherds of shelly ware, weighing 925.4 g, were collected during the 1998–2002 fieldwork at Kaupang. As already noted, 140 sherds are from stratified contexts (70.4%). Only 16 sherds (69.7 g) have been recovered from the ploughsoils as the shelly ware does not keep well in this context at Kaupang due to its porosity after the leaching of the shells.

10.3.6 Grey wares

As we reach the grey wares a word of caution is needed. It is very hard, if not impossible, to separate most of the undecorated body sherds of grey ware into groups with a known place of origin on the basis of visual examination. The reason is that the fabrics are simply too alike.

An attempt has recently been made to distinguish fabrics based on the extensive analysis of grey wares from Groß Strömkendorf (Brorsson 2005), including thin-sectioning and grain-size variation. Even this very thorough work produced few general guidelines. As a result, only 20% of the grey wares from this site could be classified as Slavonic, Scandinavian, Frisian or Saxon (Brorsson 2005:45).

An attempt was made to separate types of grey ware from stratified deposits in the MRE on the basis of a visual description of grain-size variation, colour and hardness. Except for one group of very coarse grey ware sherds, this produced no reliable results. On the basis of thin-sectioning and ICPS, Vince has been able to define fabric-groups amongst the grey ware from the stratified deposits in the MRE (this vol. Ch. 11:307–9),). However, his fabric-groups do not match my grouping of the material based on visual examination. Moreover the origin of the pottery cannot be pinpointed because the geology of Denmark, the southernmost Sweden and the Baltic region is simply too uniform to allow this. For the present, it seems that research into Viking-period pottery in Scandinavia and the western Baltic coastlands has to live with the problem of not being able to provenance undecorated body sherds of grey ware, which often make up the bulk of the material from sites in this region.

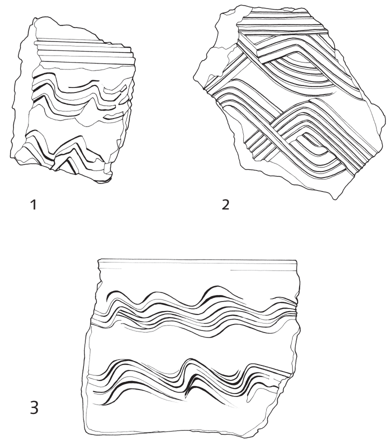
Not all is lost, however. It is possible to identify some of the grey wares by vessel-shape and decoration. But even though some vessel-shapes are very common in certain areas, they may also be present, if more rarely, in neighbouring regions. Consequently, the attribution of a diagnostic vessel sherd to a specific provenance is problematic. In the following, therefore, I will refer to the hemispherical bowls that are so common in Jutland simply by their shape, not their suspected place of origin. Pots of Slavonic types were being manufactured in southern Scandinavia too, but mainly in the 10th and 11th centuries (see Roslund 2001), which has no relevance to the Kaupang finds as there is no post-9th-century Slavonic material in the ceramic assemblage.

Decorated body sherds are rather less problematic as some styles derive from specific regions, such as the characteristic wavy bands of the Feldberg pottery found in the Slavonic area. However, other types of decoration appear over wide areas of northern Europe (e.g. stamped decoration) and so are less easy to use. Only with larger sherds is it possible to see which tradition the decorated pottery belongs to from the composition of the design. The small sherd-size at Kaupang often prevents this method being used.

Turning now to the different pottery traditions of southern Scandinavia and along the Baltic shore, there are several different traditions, some of which tend to blend into other traditions on a regional level.

Grey ware from Jutland. The Jutlandic peninsula is dominated by hemispherical bowls with a rounded base, usually undecorated. Where there is decoration, it takes the form of stamped decoration on the upper part of the body (Madsen 1991).

Figure 10.22 *Decorated sherds of Slavonic ware from stratified contexts in the MRE (**1–2:** C52519/23556, 26848 – SP II; **3:** C52519/25911 – SP III). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*



An exception is the hard-fired wheel-thrown pottery from Ribe. This has not been identified at Kaupang, and does not seem to have had a widespread distribution outside Ribe (Feveile et al. 1998).

Grey ware from the Danish islands and south-eastern Sweden. The Danish islands and south-eastern Sweden are represented by bowl-like vessels with an in-turned rim. They differ from the Jutlandic examples primarily by having a flat base. The vessels are normally undecorated (Madsen 1991).

Slavonic grey ware. The pottery from the Slavonic areas has been divided into a series of different traditions following the work of Ewald Schuldt (1956) based on vessel-shape and decoration. However, the classification of the Slavonic grey wares is not straightforward, as the borders between the groups are unclear, and specialists often disagree on the grouping. In the case of Kaupang three Slavonic traditions can be recognized: Sukow, Feldberg and Menkendorf. Of these, the Feldberg is by far the most common. The dominant vessel-type is a biconical pot with an out-turned rim and a flat base.

Sukow is one of the earliest groups of Slavonic pottery. It is characterized by an S-shaped body and an out-turned rim. The vessels were built entirely by hand, and not subsequently shaped on a turntable. Sukow pottery is rarely decorated. This type of pottery was very common in the West Slavonic areas. Production started in the mid-7th century and continued well into the 9th (Wietrzichowski 1990).

Feldberg pottery is of much the same shape as Sukow. Characteristic of Feldberg pottery is its decoration of wavy bands of lines. The vessels were constructed by hand, and the rim was then shaped on a turntable. Feldberg pottery appears in the mid-8th century and continues in use throughout the 9th (Brather 1996:145 and 150–1).

Menkendorf pottery is characterized by the biconical profiles of the vessels, an out-turned rim and a long neck. The vessels were constructed by hand and subsequently shaped on the turntable. Pottery in the Menkendorf tradition is decorated with straight lines, wavy lines and impressions. It appears in the 8th century and continues into the 10th (Schuldt 1956:9–16).

Fresendorf pottery is a mainly 9th- and 10th-century tradition, with production centred on the island of Rügen. Vessels belonging to this tradition are normally decorated with straight and/or wavy lines, often quite profusely. The vessels were constructed by hand and then shaped on the turntable. The rim is often in-turned. The vessel profile is reminiscent of a wide barrel (Schuldt 1956:25–30). This type has not been recognized at Kaupang, although it may be present among the highly fragmentary Slavonic material.

Saxon pottery. Saxon pottery is mentioned here as small sherds of this type of pottery may easily be mistaken for Scandinavian or Slavonic pottery. Saxon pottery can have a variety of shapes, with both flat and rounded bases. It differs from Slavonic and Scandinavian pottery by having angled edges between segments of the vessel's profile. It is normally undecorated but may carry stamped impressions on the shoulder. Handles are sometimes found.

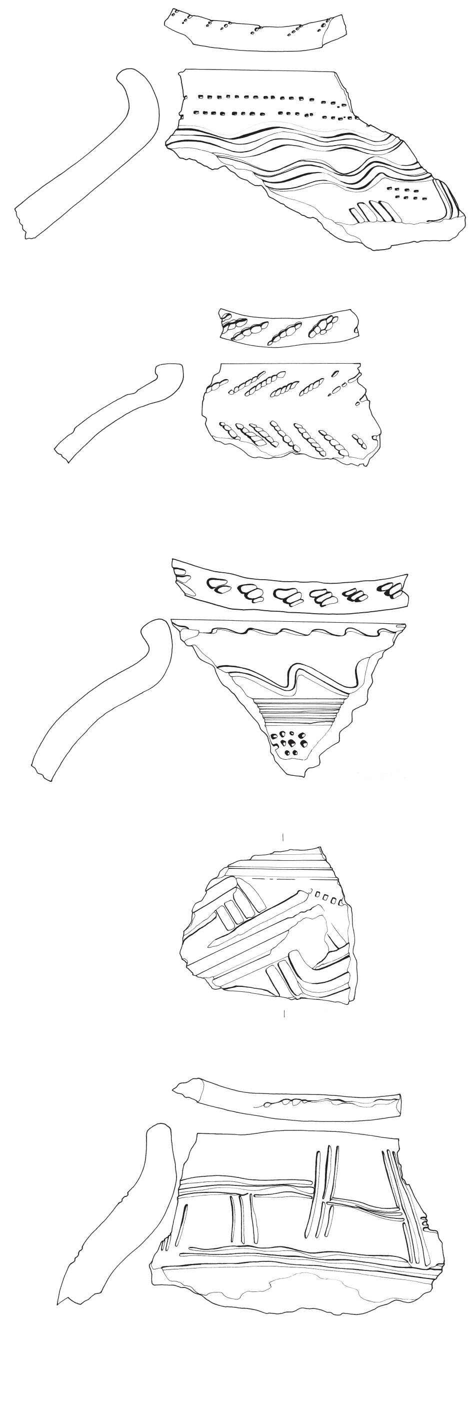
Frisian coarse ware. Small sherds of Frisian coarse ware could also be mistaken for other types of more common grey ware at Kaupang. The main vessel-types are the *Eitopf* and globular vessels, sometimes handled. It is dated to the 8th–10th centuries. Decoration normally takes the form of stamped impressions. Examples of Frisian coarse ware are illustrated by Steuer (1979).

Because of the need to make some sort of grouping of the grey ware, it has been divided into the following four groups.

Sherds of clearly Slavonic origin

A number of sherds can be identified as Slavonic, either from their decoration or from the presence of

Figure 10.23 *Decorated sherds of Slavonic ware from unstratified contexts at Kaupang (1–5: C52516/3116, 5846, 5850, C52519/10929, 16419). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*



turning marks on the rim from shaping on a turntable. Due to the small size of the decorated sherds, however, it is hard to determine to which Slavonic pottery tradition they belong. Those that can confidently be identified are of the Feldberg tradition; in a few cases the Menkendorf (Fig. 10.22). Sukow sherds have not been identified in this group, as this type is rarely decorated. A few sherds with outturned rims bear marks of shaping on a turntable. In northern Europe the turntable was only used in the Slavonic areas. If the identification of the turning marks on the rim sherds is correct, these sherds must be Slavonic. This can sometimes be difficult to determine.

111 sherds of Slavonic origin were recovered from stratified deposits (Tab. 10.6). 10 of these were recovered from SP I contexts, but again Plots 2A/2B account for contexts for the majority of these. In this case, however, two sherds (C52519/26750: see Fig. 10.21) were recovered from the neighbouring plot 3A, in layer AL100381, the primary occupation deposit here. The deposit in question was sealed by a layer of beach sand c. 5 cm thick which had been spread out on the plot prior to the building of the first house there. It is therefore unlikely that the two sherds here, of the Feldberg tradition, are intrusive. They more probably indicate the presence of Slavonic people at Kaupang during the initial seasonal settlement.

Slavonic pottery was primarily used for cooking at Kaupang. Of the 57 find-units of Slavonic pottery from stratified contexts, 25 contain sherds with carbonized residue – in most cases food residue on the lower part of the inside of the vessels.

A further 162 sherds of Slavonic origin were recovered from unstratified contexts (Fig. 10.23).

In contrast to the Frankish pottery, where the presence of Franks is supported by dress accessories, Slavonic pottery is the only indicator of Slavs at Kaupang. If this evidence can be taken at face value, then it is likely that Slavs were present at Kaupang as early as the initial seasonal settlement, and on throughout the 9th century. The later *Gurtfurchenware* is not present, indicating that there is little if any 10th-century Slavonic ware at Kaupang.

Stamped sherds

A total of 37 sherds have stamped impressions on their surface. 19 of these sherds have been recovered from stratified deposits. The stamps are classified according to Brather (1996:35; Fig. 10.24).

Context	Sum	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3A	Plot 3B	Other
SP I	10			6	1	2		1
SP II	76	24	8	2		22	3	17
SP III	4							
SP I–III	21							

Table 10.6 *The distribution of sherds of Slavonic origin in the stratigraphic sequence of the MRE (sherd-count only). The "Other"-group is mainly from plot-divisions.*

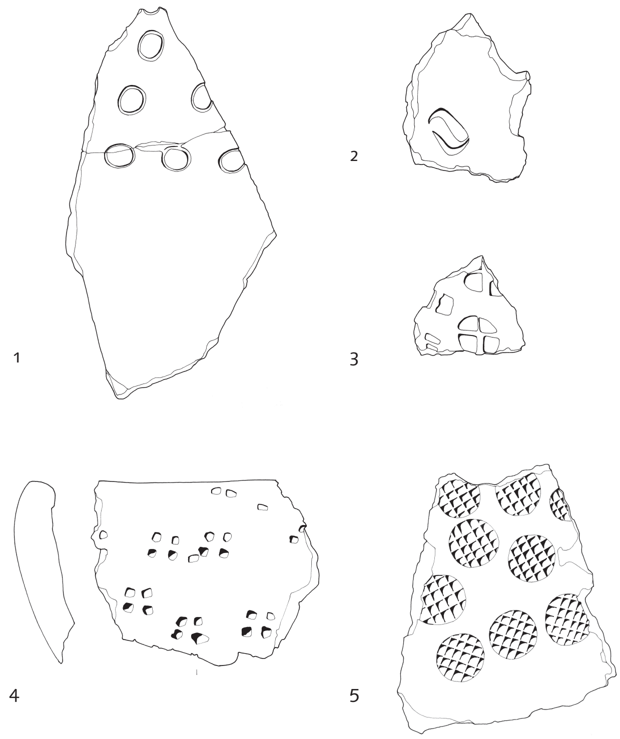


Figure 10.24 *Stamped pottery recovered during the 1998–2002 fieldwork at Kaupang. (**1:** Brather type 32: C52516/3369; **2:** Brather type 34: C52519/12825; **3:** Brather type 36: C52516/1883; **4:** Brather type 37: C52519/24834; **5:** Brather type 38; C52519/20758. (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

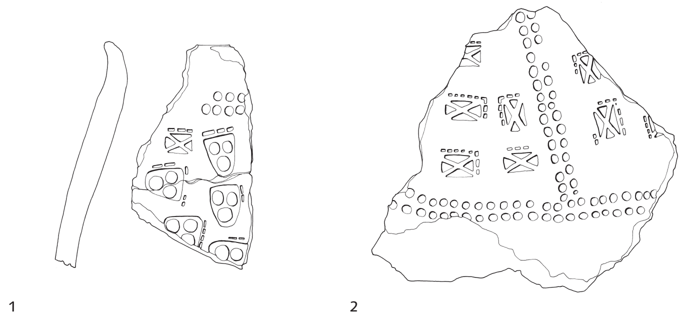


Figure 10.25 *Stamped pottery (**1:** C52516/2622, **2:** C52519/16404). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Stamp type	No.
32	3
34	2
36	6
37	8
38	6

Table 10.7 *Quantification of stamp-types (following Brather 1996:35)*

The stamps present are Brather types 32, 34, 36, 37 and 38 (Tab. 10.7). Stamps of type 37 have been found on two rim sherds, both in-turned and from hemispherical vessels. Stamp-type 36 was found on two rim sherds with out-turned rims and one rim sherd with a vertical rim.

Remarkable amongst the stamped pottery is a group of 11 sherds (7 from stratified contexts) which have very distinctive stamped decoration (Fig. 10.25). The decoration consists of three elements: a double row of points (which appear to have been placed horizontally below the rim), a rectangle with incised straight lines running from opposite corners (a kind of St Andrew's cross but in a rectangular frame), and a "shield"-like stamp with three raised circles inside.

One of these 11 sherds was recovered from a SP I context (as the only stamped sherd), but again this was on Plot 2A, making the association somewhat doubtful. ICPS analysis by Vince (this vol. Ch. 11) of two sherds has shown that they have a distinct fabric, but their place of origin cannot be identified. Typologically, they are similar in appearance to

Context	Sum	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3A	Plot 3B	Other
SP I	1			1				
SP II	42	22	3	9	5		3	
SP III	3							
SP I–III	11							

Table 10.8 *The distribution of sherds with in-turned rims in the stratigraphic sequence of the MRE (sherd-count only).*

Context	Sum	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3A	Plot 3B	Other
SP I	5	3		2				
SP II	18	3	2	5	2	2	2	3
SP III	3							
SP I–III	7							

Table 10.9 *The distribution of sherds with out-turned rims in the stratigraphic sequence of the MRE (sherd-count only). The "Other"-group is mainly from plot-divisions.*

7th-century Norwegian pottery known from graves (Gudesen 1980), and it may be that this type of pottery was produced into the Early Viking Period as well. If this was the case, it was not made at Kaupang, as the sherds do not match samples of local clay. Another possibility is that the sherds are from old vessels which had remained in use long after their date of production. This would be abnormal as pottery is so fragile. Nevertheless, a few sherds of 8th- and even 7th-century Continental pottery have been recovered as Kaupang, so the possibility of long-term survival cannot be discounted. It is likely that ten of the eleven sherds are from a single vessel, as they have identical stamps and patterns of decoration on a reduced fabric. They were also recovered from the same area on and around plot 3B. Only one oxidised specimen must be from a different pot.

Sherds with in-turned rims

A total of 313 sherds of grey ware (excluding the identified Slavonic sherds) are rim sherds. 152 of these have in-turned rims, and 57 of those were recovered from stratified contexts in the MRE (Tab. 10.8). Only one sherd is from SP I, but again from the dubious plot 2A.

Most of these sherds derive from hemispherical vessels or flat-based vessels with in-turned rims. This would indicate that they originate from Jutland, Fyn, Sjælland or Skåne. Some small rim sherds may derive from bowls, which would extend their possible area of origin to include the Slavonic areas and possibly parts of Sweden beyond Skåne.

Remarkably, no in-turned rim sherds were recovered from plot 3A, SP II. In contrast, this plot yielded 22 sherds of Slavonic origin (Tab. 10.8). One sherd with an in-turned rim has an incised line below the rim (C52519/23118).

Sherds with out-turned rims

80 sherds with out-turned rims were recovered, 23 of which belong to stratified deposits in the MRE (Tab. 10.9).

Sherds with out-turned rims may in many cases derive from vessels originating in the Slavonic areas, where this type of rim is found in several traditions; most relevant to Kaupang are the Sukow and Feldberg traditions. Three of the out-turned rims were recovered from SP I contexts on plot 1A, which fits nicely with the presence of two sherds of Feldberg pottery from plot 3A in SP I.

Grey ware in general

No less than 2,533 sherds of grey ware are left that cannot be assigned to any of the groups above (81.1% of the 2,975 sherds of grey ware in total). This group consists of un-diagnostic rim sherds, undecorated body sherds and base sherds.

Looking at all the grey ware together, 1,121 sherds derive from stratified deposits in the MRE. Table 10.10 confirms that grey ware was present from SP I in the MRE, even if sherds from the questionable plots 2A and 2B are disregarded.

10.4 Discussion

The ceramic assemblage from the stratified deposits in the MRE is dominated by grey wares both by weight and sherd-count – not by Vorgebirge wares, as was the case in the excavations of 1956–1974. As already noted, the reason for this is that the assemblage from the 1956–1974 excavations was mostly recovered from disturbed deposits and collected by hand, favouring the survival of the high-quality, light coloured Vorgebirge wares. The question remains, however, of how far the collection recovered from the MRE matches the "life" assemblage

Context	Sum	Plot 1A	Plot 1B	Plot 2A	Plot 2B	Plot 3A	Plot 3B	Other
SP I	153	47		90	12	2		2
SP II	714	212	40	115	54	155	66	72
SP III	47							
SP I–III	207							

Table 10.10 *The distribution of all sherds of grey ware in the stratigraphic sequence of the MRE (sherd-count only). The "Other"-group is mainly from plot-divisions.*

of the early 9th century at the settlement. This is a very difficult question to answer, but an important one, as different functions for pottery are mirrored in different breakage rates. Cooking pots generally have a short life-span while storage containers may last considerably longer (see Orton et al. 1993:207–9). Thus a high proportion of broken cooking pots does not correspond directly with a similarly high proportion of cooking pots in the "life" assemblage. Large storage containers also produce many more sherds than the smaller cooking pots when they break.

At Kaupang, the situation is made even more complicated by the fact that this society was non-pottery producing, and dependent on the supply of pots by boat. Except for the Tating Ware, most pots were not even brought to Kaupang as trading items, but simply carried along on the boats for personal use, either as cooking pots or containers. More care may have been put into the handling of pots as a result. At the same time, the shortage of pottery may have led to the pragmatic use of storage pots for cooking, as evidenced by the sooted *Reliefbandamphorae*. Confusing the issue further, vessels of other materials were used alongside the pots.

A large proportion of the grey ware in the MRE shows internal food residues, attesting to its use as cooking pots. The Vorgebirge pottery retrieved at Kaupang is normally not sooted, with the odd exceptions mentioned above. The function of the *Reliefbandamphorae* was primarily storage, while the function of the *Kugeltöpfe* and pitchers at Kaupang may have been more varied. The high proportion of grey ware cooking pots in the stratified MRE assemblage is thus unlikely to represent the "life" assemblage accurately. The Vorgebirge wares, some of which were containers, were probably more frequent than the archaeological assemblage suggests, although by how much it is difficult to say.

A comparison of the ceramic assemblage from the MRE with assemblages from other Scandinavian Viking-period urban sites highlights the remarkable presence of Continental wheel-thrown wares, especially the Vorgebirge wares (Blackmore 2001; Bäck 1995:fig. 17; Tab. 10.11). Even disregarding the very high proportion of 67.9% of Continental wheel-thrown wares in the excavation of 1956–1974 (by sherd-count, based on Hougen's catalogue) affected by post-depositional processes, and substituting the 25.6% in stratified deposits in the MRE, this still seems a remarkably large quantity to have come from an area about a thousand kilometres south of Kaupang.

Site	Imports (% of total ceramic assemblage)	Continental wheel-thrown wares (% of imports)
Kaupang	100	25.6
Ribe	6	43.9
Birka	25	9

Table 10.11 *The percentage of imported wares in Kaupang, Ribe and Birka, total and Continental wheel-thrown wares.*

To compare the percentages of pottery at the urban sites of the Viking Period (as described above) with Kaupang is not straightforward, however, as Kaupang was situated in an aceramic region. At the other urban sites the vast majority of the pottery was locally made, dominating quantitative charts of the pottery assemblages. At Ribe, for instance, only 6% of the pottery from the 1970–76 excavation assemblage is imported. Yet 43.9% of these imports were Continental wheel-thrown ware, mostly "Badorf ware" (Madsen 2004). In comparison, the figure of 25.9% at Kaupang is not so remarkable.

Comparing the figures from Kaupang with Hedeby is also difficult as the size of the total ceramic assemblage at Hedeby is not quite clear. The percentage of imports there is given as 7% but this number includes only the western Continental wheel-thrown wares not the Slavonic wares or the shelly wares, making a comparison similar to that with Ribe impossible. Janssen (1987:71) gives figures of 32.3 kg of Badorf-type Ware and Walberberg-type Ware, 0.3 kg of Mayen ware and 3.4 kg of Tating Ware, in addition to 57.5 kg of *Reliefbandamphorae,* amounting to a total of 93.4 kg of 9th-century Continental wheel-thrown pottery at Hedeby (excluding the Hunneschans pottery, which is not present at Kaupang – see below). The excavations

		Total			1A			1B			2A		
		Grey ware	Continental	Shelly ware	Grey ware	Continental	Shelly ware	Grey ware	Continental	Shelly ware	Grey ware	Continental	Shelly ware
SP I	Sherdcount	153	43	44	47	1	1	0	0	0	90	21	40
	%	63.8	17.9	18.3	95.9	2.0	2.0				59.6	13.9	26.5
SP II	Sherd count	698	179	74	212	43	1	40	6	0	115	24	16
	%	73.4	18.8	7.8	82.8	16.8	0.4	87.0	13.0	0.0	74.2	15.5	10.3
SP III	Sherd count	47	73	4									
	%	37.9	58.9	3.2									
SP I–III	Sherd count	207	148	9									
	%	56.9	40.7	2.5									

		2B			3A			3B			Other		
		Grey ware	Continental	Shelly ware	Grey ware	Continental	Shelly ware	Grey ware	Continental	Shelly ware	Grey ware	Continental	Shelly ware
SP I	Sherdcount	12	20	0	2	0	0	0	0	0	2	1	3
	%	37.5	62.5	0.0									
SP II	Sherd count	54	41	2	155	16	20	66	41	25	56	8	10
	%	55.7	42.3	2.1	81.2	8.4	10.5	50.0	31.1	18.9	75.7	10.8	13.5
SP III	Sherd count												
	%												
SP I–III	Sherd count												
	%												

Table 10.12 *Sherds identified by ware, sorted by plots and Site Periods. Sherds of unidentified origin and wares are not included.*

at Hedeby were conducted on a much larger scale than at Kaupang, but how much larger we cannot tell. Comparing the weight of the sherds at these two sites is thus not meaningful.

In Birka 25% of the pottery from the 1991–1995 excavations was imported. Only 9% of the imports were of Continental wheel-thrown wares. This is not surprising given the location of Birka.

Kaupang, Birka and Ribe share the absence of Hunneschans pottery and 10th-century Pingsdorf-type Ware. In the case of Ribe, this is not hard to explain, as generally very little has been found from the second half of the 9th and the 10th century in the town. At Kaupang, however, the absence of these wares is more conspicuous, as the town was still functioning as a trading place in the late 9th century and at least into the first decades of the 10th (Pilø 2007:177–8). The Hunneschans pottery horizon is dated to the last quarter of the 9th century and the first decade of the 10th (Sanke 2001:307–8), while the Pingsdorf-type Ware is dated c. AD 900 onwards (Sanke 2001:326–7). One would expect it to have been present if trade was going on between the Frankish area and Kaupang then. Hunneschans pottery and especially Pingsdorf-type Ware have been found in large quantities at Hedeby, attesting to their active presence in the trade connexions (Janssen 1987). The absence of the later Frankish wares at Kaupang is evidence that trade with the Frankish area had ceased by the last quarter of the 9th century. Whether this change happened around c. 880 or a little earlier is difficult to determine, as the Vorgebirge wares prior to the Hunneschans horizon are not very closely dated. However, the sixteen sherds of Carolingian Pingsdorf-type Ware, which are mainly dated to the second half of the 9th century, indicate that the direct contact was still active at least in the mid-9th century or maybe a little later.

It seems an obvious inference to connect this break in trade connexions with the Franks with the demise of Dorestad in the 860s. If most of the Continental pottery was carried on ships from

Dorestad to Kaupang and Birka, then the destruction of Dorestad could have led to an end of the influx of pottery from the Rhineland. But if the demise of Dorestad was the only reason for this, how did the Pingsdorf pottery still find its way to Hedeby in such remarkable quantities? Further factors were probably involved in the change of pottery supply to Kaupang.

It is noteworthy that no pottery recovered from Kaupang can securely be dated to the 10th century. The younger Slavonic *Gurtfurchenware* is absent. If the pottery can be taken as an indicator of visiting foreign traders, then there is little to suggest that Kaupang was visited by non-Scandinavians in the 10th century at all – and possibly some decades earlier. This change in pottery supply to the site may have been the result of several factors, but the leading cause is likely to have been changes in trade and exchange. These could have led to Kaupang changing from an international urban settlement for foreign merchants to a primarily regional marketplace. Of course, this hypothesis needs to be substantiated by a broader analysis of all the available material (Skre, this vol. Ch. 17:447–9).

Table 10.12 provides an overview of the composition of the ceramic assemblage, sorted by Site Periods and plots. Generally, grey ware dominates on all the plots, except for Plot 2B. Here Continental wares are predominant, but this is probably the product of a single broken *Reliefbandamphora* dumped here. No great emphasis should be placed on individual variation amongst the plots.

All the same, the composition of the ceramic assemblage from SP I is remarkable. Disregarding the troublesome plots 2A and 2B, only two out of 52 sherds are of Continental origin: one sherd is of Walberberg-type Ware and the other of shelly ware. The remaining 50 sherds are grey ware. Five of these have diagnostic features: two derive from a Feldberg vessel and three have out-turned rims. It is possible that this is evidence that the connexions with Jutland, Frisia and Frankia were not as strong in the earliest, seasonal settlement as in the later, permanent phase. Given the low number of sherds, though, it would be hazardous to attach too much significance to the range of ceramic evidence from SP I.

10.5 Summary

The presentation and analysis of the pottery collected during the 1998–2002 fieldwork at Kaupang has given new information on the wares present on the site, the time-frame of the importation of pottery, the use of ceramics on the site, and the impact of post-depositional processes on the whole ceramic assemblage.

Even though the analysis has shown that Vorgebirge pottery is not as dominant as was previously believed, it is still present in a remarkable quantity. The even higher numbers found during the 1956–1974 excavations were caused by the recovery of Vorgebirge pottery from disturbed contexts, where the good quality of these wares led to a higher collection rate compared with the softer grey wares and shelly ware. Collection was also done by hand, favouring the brightly coloured Vorgebirge wares. Since the frequency of the imported wares is not balanced by the presence of a large quantity of local pottery, care must be taken in interpreting the assemblage. Even so, the number of Vorgebirge sherds is remarkably high, and probably reflects direct contact between Kaupang and Dorestad, the most likely outshipping port. It may be that the importation of Vorgebirge wares only really started with Site Period II, that is from c. AD 805/810 onwards. As no Hunneschans or Pingsdorf-type Wares are present at Kaupang, it is likely that the importation of Continental wares ceased sometime between c. AD 860 and 880, possibly at the time of the demise of Dorestad.

Besides the Vorgebirge pottery, Mayen wares are present, albeit in a small quantity. Sherds of a red-painted buff ware, most likely a Zelzate costrel, were recovered, the first of its kind from a Scandinavian site. It is also possible that there is a handful of sherds of French white wares, but this could not be confirmed by thin-sectioning or ICPS analysis.

The very low frequency of shelly ware in the assemblage from the 1956–1974 excavations is very probably due to most of the excavated deposits being disturbed. The 2000–2002 excavations clearly showed that shelly ware has a low survival rate in such contexts. This is a result of its porous fabric. In intact stratified deposits, shelly ware is a distinct part of the assemblage but, as with the other Continental wares, it becomes more frequent from Site Period II onwards. The production of Frisian shelly ware is mainly a 9th-century phenomenon, so this type of pottery cannot give information on the later part of the settlement.

The coarse grey wares constitute the great majority of the ceramic assemblage, but are more difficult to extract information from. Non-decorated body sherds form the bulk of the coarse grey-ware assemblage and so far it has not been possible to sub-group these according to their origin.

Analysis of morphological and ornamental details is necessary to distinguish between Scandinavian and Slavonic wares. The highly fragmented assemblage from Kaupang makes this very hard. Some Feldberg and Menkendorf sherds could be identified. In addition, in-turned and out-turned rims were analysed. In-turned rims are believed to derive mainly from southern Scandinavian vessels, while the out-turned rims are mainly, but not exclusively, Slavonic. Stamped decoration could have helped here to separate Jutlandic and Slavonic wares further, but the same type of stamp can be found on both Jutlandic and Slavonic vessels. If the sherds had been large enough it would have been possible to distinguish the two categories by the overall decorative designs but the small size of the sherds makes this impossible. In general it can be said that Slavonic wares are present throughout the stratigraphic sequence, while in-turned rims – probably from southern Scandinavia – have been found only from SP II onwards.

Sooting on many sherds has revealed their use as cooking pots. This is especially the case with the grey wares. However, some of the Vorgebirge amphorae were used for cooking, even though this was hardly their original function on the Continent. This pragmatic use of pottery might reflect the presence of people from the Frisian/Frankish area who preferred to use their own pottery for cooking instead of the Scandinavian and Slavonic coarse wares or the soapstone vessels available on the site.

It has proved very difficult to estimate to what extent the ceramic assemblage from Kaupang mirrors the actual use of the various types of pottery on the site in the Viking Period. The quality of the pottery, the function of the various pots, and post-depositional processes, are the main factors modifying the archaeological record. The large, hard-fired Vorgebirge amphorae would have produced a large number of sherds once broken, but at the same time these were used mainly for storage, and so not likely to have suffered a high frequency of breakage. The softer grey wares were used mainly as cooking pots. These very probably suffered a high frequency of breakage, and will thus have a markedly higher presence in the archaeological record than in the "life"-assemblage.

The absence of definite 10th-century pottery at Kaupang could indicate that the function of the site changed during its life-span, from an international urban settlement with Scandinavian, Slavonic and Frankish/Frisian merchants to a primarily regional centre of trade. This hypothesis needs to be tested and supported by the analysis of a wider range of evidence.

Kaupang remains the only Viking-period site in Norway with a substantial ceramic assemblage. During its life in the Viking Period, however, it was one of several Scandinavian sites of a similar character – each with its own pattern of contact and trade. This is mirrored in the ceramic assemblages, especially at Kaupang where all the pottery seems to have been brought to the site by visitors from other parts of Scandinavia, Frankia/Frisia and the Slavonic areas. In this respect, the site is unique, even amongst the Scandinavian Viking-period towns.

Acknowledgements

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Characterisation Studies of Pottery, Industrial Ceramics and Fired Clay

11

Alan Vince †

It has been an accepted fact that Viking-age Norway was aceramic and that pottery found at sites such as Kaupang was therefore imported, either from some other part of the Viking world or from further afield. To test this model, and to try and establish the source of the pottery used at Kaupang, a series of samples were taken of the hand-made grey wares, the crucible- and mould-fragments and the fired clay from the Kaupang excavations. Morphological and contextual analysis of the pottery vessels is published by Lars Pilø in this volume (Ch. 10), while such analysis of crucibles, moulds and fired clay will be published by Unn Pedersen (in prep.).

These samples, together with two samples of wheel-thrown white wares examined to test their visual identification (Vince 2007a), were examined using thin sections and chemical analysis. They were compared with material of similar appearance from Jutland, North-West Germany and Skåne (Vince 2006, 2007).

The results confirm that there is a considerable difference between the petrological and chemical characteristics of the hand-made grey wares and the fired clays and moulds, which is best explained by interpreting the hand-made grey wares as imported vessels while local clays were used for loomweights, hearth lining and other purposes. The imported white wares consisted of a red-painted vessel, comparable to the Zelzate costrel (Hodges 1981:63), and a vessel tentatively identified as a French product. Both compare well, in thin section and chemical composition, with material from the Vorgebirge, in the middle Rhine valley and are therefore confirmed here as Rhenish wares of Badorf-type Ware.

11.1 Methodology

Thin sections were produced at the University of Manchester by Steve Caldwell and stained using Dickson's method (Dickson 1965). Samples were also prepared for chemical analysis by mechanically removing the margins and surfaces and crushing the remainder to a fine powder. This powder was then analysed at Royal Holloway College, London, under the supervision of Dr J. N. Walsh using Inductively-Coupled Plasma Spectroscopy (ICP-AES).

11.2 Local clay and temper resources

Clay deposited below present sea-level forms the geological foundation of the settlement at Kaupang (Sørensen et al. 2007). The upper surface of this clay was recorded on site as "white clay" and is probably a podzol developed on the subsoil. Unfortunately, no samples of either clay were available for study although two samples of marine clay from the Kaupang area were analysed at the University of Oslo in the early 1970s (Roaldset 1972) together with a large number of samples of clays and other Quaternary sediments from sites in the Numedal area.

11.3 Crucibles

Fourteen samples of crucible were analysed. Using thin sections they could be assigned to three fabric-groups: KM5, KM6 and KM7. All fourteen samples have low values for magnesium and iron and major constituents of illite and montmorillonite. Together with their off-white colour, this suggests that the parent clay was kaolinitic.

Fabrics KM5 and KM6 both contain angular fragments of a rock containing perthite, microcline feldspar and quartz, whereas fabric KM7 contains very angular quartz-fragments together with minor perthite. The rock-fragments in KM6, however, include a wider range of minerals than found in KM5. In KM7 it is likely that the inclusions were

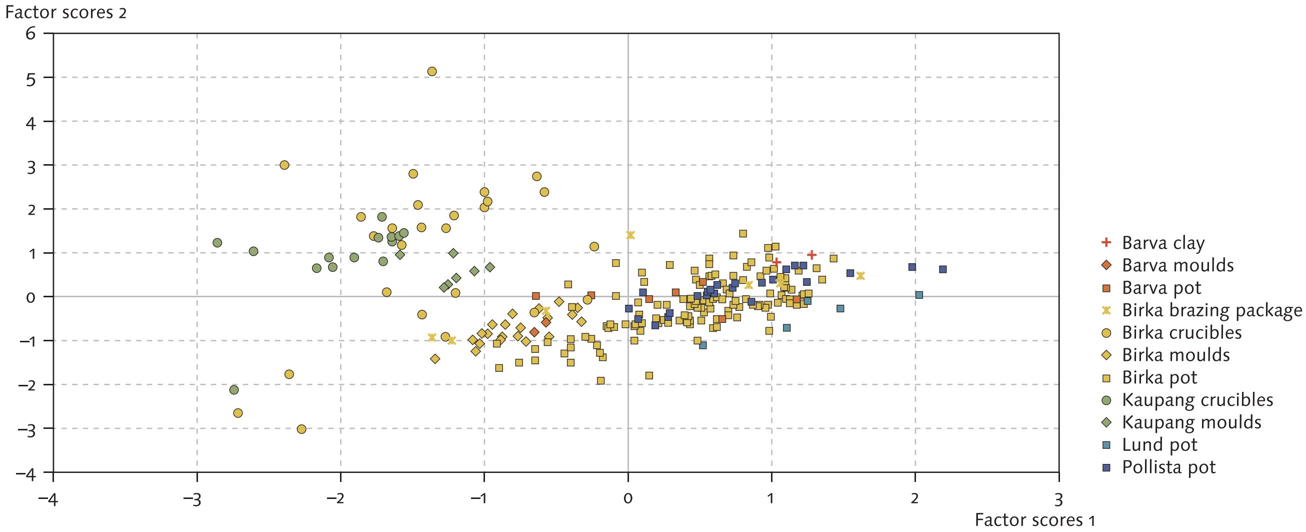


Figure 11.1 *Bi-plot of Factor 1 and 2 scores showing the separation of the Kaupang and Birka crucibles from other Scandinavian pottery and industrial ceramic samples.*

Figure 11.2 *Bi-plot of Factor 1 and 2 scores for crucibles from Birka and Kaupang*

deliberately prepared and added to the clay, probably through fire-cracking. The groundmass in each case consists of vesicular isotropic glass. In addition, most of the crucible samples were coated with a darker coloured glass which was deep blue in the thicker parts of the sample and brown closer to the surfaces. This colour change is presumably due to differences in redox conditions.

Chemical analysis of the crucible samples confirms that the KM7 sample has a higher estimated silica content (72.8%) than the remaining samples which range from 61.6% to 70.3%. The chemical data also indicate other differences between KM7 and the other crucible fabrics, besides lesser differences between KM5 and KM6. The three fabric-groups, therefore, have different chemical compositions, although whether these are due solely to the different materials used as temper or to the source of the clays is unknown.

The Kaupang crucibles were then compared with various other groups of ceramics from Scandinavia, including crucibles of similar appearance from Birka. The data come from three sites in central Sweden: samples of clay, pottery and mould-fragments from Barva, Södermanland; moulds and pottery from Birka, on Björkö in Lake Mälaren; and pottery from Pollista, Håbo. Factor analysis of the chemical data confirms this similarity (Fig. 11.1).

The crucibles from Kaupang were then compared with the Birka crucibles alone, which were divided into three fabric-groups on the basis of thin-section analysis.

Birka Crucible Fabric 2 has a similar or identical aplite-derived inclusion suite to KM5. Birka Crucible Fabric 3 has a mixture of coarse aplite-derived inclusions together with fine angular quartz sand. Birka Crucible Fabric 4 lacks the aplite-derived inclusions and is probably a collection of different fabrics including one containing angular quartz similar to that in KM7 whilst others contain abundant quartz silt, abundant quartz and muscovite silt or a rounded granite/aplite-derived sand.

In this analysis, three factors were found, and a plot of Factor 1 against Factor 2 grouped all three Kaupang fabrics with the Birka Crucible Fabric 3 and some of the Fabric 4 samples (Fig. 11.2). Surprisingly, the fabric with the closest petrological match to Kaupang, Birka Crucible Fabric 2, forms a distinct cluster. These results suggest that there is no one-to-one match between the Kaupang and Birka crucibles but that they were indeed made from similar mate-

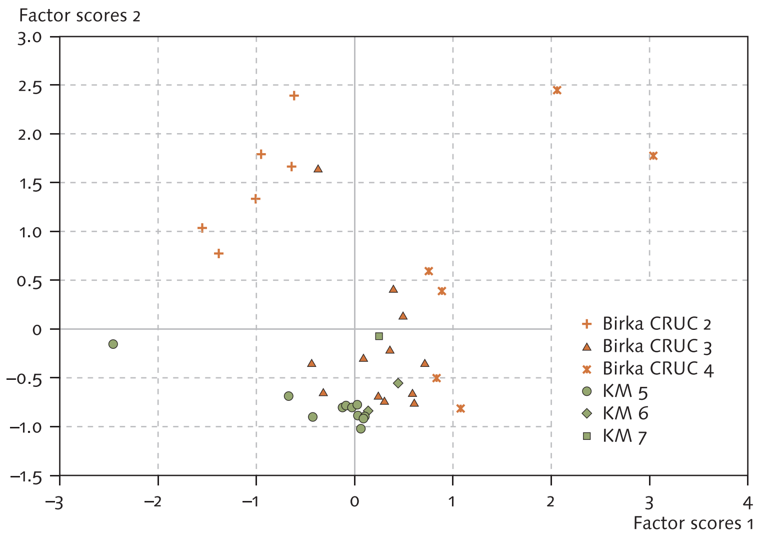
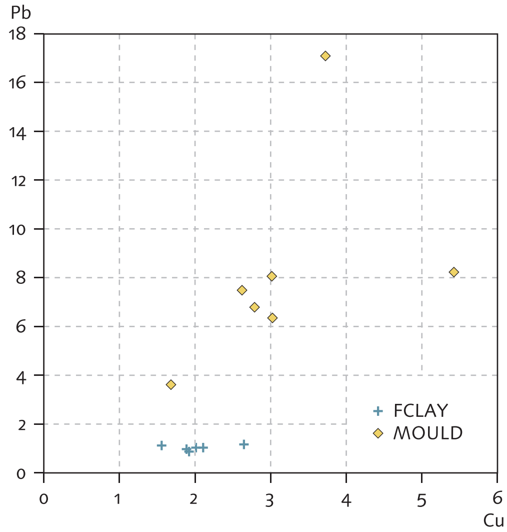


Figure 11.3 *Comparison of lead to copper frequencies (relative to aluminium) in the Kaupang mould and other fired clay samples.*



rials and have similar petrological characteristics. These similarities could be due to the use of different batches of the same raw materials at both sites or to the selection of materials with similar properties at both sites. Either interpretation implies a high degree of organisation and a technology shared at both sites.

11.4 Moulds

Seven samples of moulds were examined in thin section and by chemical analysis. In thin section, four fabric-groups were identified, although these were mainly defined by differences in texture rather than composition. KM3 and KM4, for example, contained moderate organic inclusions absent from KM1 and KM2. All contain a mixture of rock- and mineral-fragments including quartz, plagioclase feldspar and hornblende, with perthite and fine-grained metamorphic rock-fragments present in some samples. Opaque tabular laths in fabric KM3 may be altered biotite or hammerscale.

Analysis of the chemical data indicates that there are too few samples to tell whether the four fabric-groups have any correlation in chemical composition. Comparison with the fired clays indicates that the moulds have a higher estimated silica content. Factor analysis of the fired-clay and mould samples indicates differences in the normalised frequencies of various elements, almost all of which are higher in frequency in the fired clays than in the moulds. The only exception is sodium, which is at a higher level in the mould samples. These differences, it is argued here (summarising the technical report), are explicable if the moulds were made from the "white clay" whilst the subsoil was used for other purposes. If this explanation is correct, then it is implied that the sodium is to be found in the quartzose fraction, presumably as sodium-rich feldspars. Comparing the moulds with the fired clays also indicates elevated levels of lead and copper in the moulds and differences in the ratio of lead to copper between the two groups (Fig. 11.3). It is most likely that the enhanced lead and copper levels are due to contact with these metals during use although the levels found are much lower than one would expect in other metallurgical ceramics such as crucibles.

11.5 Fired clays

Samples of a loomweight and hearth lining were thin-sectioned and these, together with four samples of unspecified fired clay, were analysed using ICP-AES. The results are consistent with the use of local clay. Comparison with the moulds (above) indicates that the moulds were also probably made from local clays, although most likely using a podzolised clay rather than the subsoil used for the fired-clay artefacts. At the same time, the difference in petrology and chemical composition between these clays and the hand-made grey wares is confirmation that the pottery vessels were not made from local raw materials.

11.6 Hand-made grey wares

Thirty-six samples of hand-made grey ware were analysed using thin sections and chemical analysis. Seven fabric-groups were identified, coded KG1 to KG7. Seventeen samples represent Fabric KG1, which is tempered with very coarse, angular rock fragments. The most common inclusion-type is granite but rounded quartz grains, mudstone and sandstone fragments also occur. The groundmass is finer in texture than that of the fired clays and moulds but contains moderate angular and sparse rounded quartz grains up to c. 0.15 mm, sometimes together with sparse muscovite laths.

Six samples were assigned to fabric KG2. This fabric also contained large angular rock inclusions, of similar character, although usually not as large, as in KG1. The groundmass, however, contained abundant fine sand composed mainly of subangular

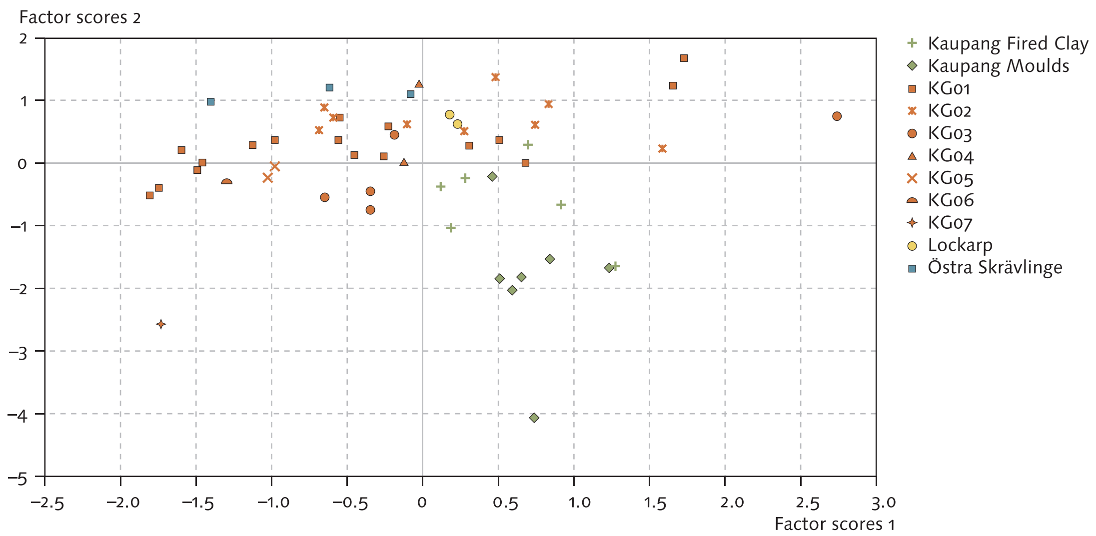


Figure 11.4 *Bi-plot of Factor 1 and 2 scores for Kaupang grey wares (KG...), mould and other fired-clay samples compared with samples from Lockarp and Östra Skrävlinge.*

quartz between c. 0.1 mm and 0.2 mm with minor muscovite laths.

Three samples were assigned to KG3. This fabric is similar in texture to KG2 but the coarser inclusions are finer and not dominated by angular granite fragments. They include rounded grains of metaquartzite and a quartz/feldspar rock, and fragments of igneous rocks of two lithologies (green amphibole/altered feldspar and quartz/amphibole/microcline). These features are similar to those found in the fired clay and the moulds but chemical analysis indicates differences in composition between the KG3 samples and both the fired-clay and mould samples and the main grey-ware fabrics, KG1 and KG2.

Two samples were assigned to KG4. This fabric shares characteristics found in other grey-ware fabrics: coarse angular rock-fragments similar to those in KG1 and KG2 and amphibole fragments and unidentified igneous rock-fragments similar to those in KG3. The fabric also contains rounded mudstone fragments. Analysis of the ICPS data indicates that the fabric has a distinct composition midway between that of KG1/KG2 and KG3.

Two samples were assigned to KG5. This fabric is almost identical to KG1 in thin section apart from the presence of rounded mudstone or clay pellets. The ICPS analyses confirm the similarity in composition between KG1 and KG5.

The petrological and chemical characteristics of KG1 to KG5 suggest that they represent distinct batches of clay, tempered in some cases with the same coarse sand/gravel and in others with different sand/gravel. Nevertheless, the links between the groups and their overall similarity in chemical composition suggest that all come from the same area. The ICPS data for these fabric-groups were compared with those from Birka and other sites in central Sweden; with Germanic Iron-age pottery from Jutland and with Viking-age pottery from North-West Germany (Kosel, near Hedeby/Haithabu), East Germany (Szczecin/Stettin), and Poland (Wolin). In each case, despite a high degree of similarity, there were always some features which distinguished the Kaupang grey wares from the remainder. Only two groups of samples matched the Kaupang grey wares closely: these come from Östra Skrävlinge and Lockarp, both in Skåne close to Malmö. The samples from the latter two sites were supplied by Torbjörn Brorsson and analysed for this project. Figure 11.4 shows the results of factor analysis of the data from these two sites and the Kaupang grey wares, moulds and fired-clay samples, and shows that by and large the data fall into two clusters: one composed of the grey wares from Kaupang and the two Scanian sites and the other composed of the Kaupang moulds and fired clays.

This result does not prove that the Kaupang grey wares were produced in Skåne but does suggest that this area, including Sjælland and the smaller Danish islands, is a likely source.

A single sample of KG6 was present. It has similar angular rock-fragments to those in KG1 and KG2, a groundmass similar to that of KG2, and contains several rounded quartz grains and a rounded flint fragment containing microfossils. The ICPS data indicate several differences between this sample and KG1 or KG2: it has a higher sodium level, and lower magnesium, cobalt, nickel, zinc, zirconium, cerium and dysprosium. These petrological and chemical features suggest that this is an isolated vessel from a different source to the remaining grey wares. The flint suggests a Danish source, perhaps Sjælland, but no samples from that island were available for comparison.

The final fabric, KG7, appears to have a similar range of inclusions to those found in KG1 but differs in the groundmass, which is isotropic and almost colourless. The ICPS data indicate high sodium and potassium contents and a copper content similar to that found in the crucibles and higher than that found in the moulds. It is possible that these characteristics are due to the use and/or burial conditions of the sherd rather than to a difference in source.

11.7 Wheel-thrown white wares

Samples of a red-painted vessel (Pilø, this vol. Ch. 10:292–3) and a white-ware vessel tentatively identified as a French product (Pilø, this vol. Ch. 10:295) were examined in thin section and using chemical analysis. Both samples share similar characteristics in thin section, which match samples of Badorf Ware. By contrast, they are quite different in texture from thin sections of white ware from La Londe in the lower Seine valley. Factor analysis of the two samples together with Badorf Ware and Walberberg Ware from London (Lundenwic), Flixborough and York failed to find distinguishing features, and it is therefore concluded that both samples are of vessels from the Vorgebirge region of the middle Rhine (Vince 2003; Vince and Young 2004; Young and Vince, in prep.).

Soapstone Finds 12

IRENE BAUG

806 soapstone objects were recovered at Kaupang during the fieldwork of 1998–2003, 131 of them from stratified deposits. Except for a single spindle-whorl related to SP I, plot 2A, the stratified finds appear in SP II and then remain present throughout the settlement history of Kaupang. The lack of soapstone in SP I may have a chronological explanation: this may pre-date the large-scale production and distribution of soapstone items in the Viking Period. However, the use of soapstone may also have been a cultural phenomenon: if the early inhabitants of Kaupang came from areas with no custom of using soapstone artefacts, this could very well explain the lack of this material in SP I.

The soapstone assemblage recovered reflects use at the site, but only a few artefacts have been found in association with a building. Most of the finds from stratified contexts were located in midden deposits, and they should be interpreted as refuse, both from the household and from craftwork.

The soapstone assemblage does not indicate any primary production of vessels at Kaupang, but there is evidence of both the secondary manufacture of small objects from vessel sherds and perhaps even of primary production of small objects – although the latter would seem to have been limited in extent.

The vessels are probably the output of the mass production of uniform goods and their occurrence at Kaupang is due to trade with regions outside Vestfold. ICP-MS analysis suggests that the majority of the assemblage stems from a single production site. The occurrence at Kaupang of soapstone artefacts other than vessels should be regarded as largely the result of those being brought to the site as personal possessions even though some of them may represent commodities. The non-vessel artefacts were most likely produced at various production sites including Kaupang. These artefacts probably do not represent mass production in the same way as the vessels.

The great majority of the soapstone artefacts retrieved from the settlement area – perhaps all of them – were brought to Kaupang to fill a local need in the town. Based on current evidence, it has not been possible to find traces of any export of soapstone goods in the settlement assemblage. Yet that possibility cannot be excluded, as Kaupang could have been a place of transit which would leave few identifiable archaeological traces.

By the beginning of the Viking Period, large-scale production of soapstone objects was underway in Norway, and the artefacts were widely distributed. The goods are found in all areas where permanent Scandinavian Viking-period settlements were located, and this output is seen as one of Norway's major industries in this period (see, e.g., Skjølsvold 1961; Resi 1979, 1987).

Soapstone is a metamorphic rock composed primarily of talc and chlorite (Helland 1893:89). The stone is soft and easy to work, and it can be subjected to heat without a high risk of fracturing. Because of these physical qualities soapstone has been utilized as a raw material for the production of several types of object used both in the household and in craft from the Late Bronze Age into recent times.

This chapter provides an overview of the different soapstone artefacts recovered from the settlement area at Kaupang during the surveys and excavations from 1998 to 2003, comprising 806 objects. The finds from the settlement area consist of vessel sherds, spindle-whorls, loomweights, sinkers, moulds and tuyères (Tab. 12.1), and the artefacts cover the most common types of soapstone object

Object type		SP I	SP II	SP III	CRM, SP I-III	Without SP	Total	
							No.	%
Vessel sherds		0	25	15	18	390	448	55.6
Spindle whorls		1	3	1	1	28	34	4.2
Loomweights		0	0	0	0	4	4	0.5
Sinkers		0	0	0	2	4	6	0.7
Tuyéres		0	5	0	1	18	24	2.9
Moulds		0	0	0	0	9	9	1
Unclassified object		0	0	0	0	1	1	0.1
Unclassified fragments		0	35	5	19	221	280	35
Total	No.	1	68	21	41	675	806	
	%	0.1	8,4	2,6	5	83,7		100

Table 12.1 *Soapstone objects from the fieldwork at Kaupang 1998–2003, showing the distribution among the Site Periods.*

from the Viking Period. Particular attention is paid to the vessel sherds, since vessels were the main soapstone artefact both at Kaupang and elsewhere.

Crafts and trading were central activities at Kaupang and the role of soapstone material in these activities as well as in the household will be analysed. Was the soapstone brought here to fill a local need in the town, or was it brought here to be traded – or both? An important issue to consider also is if there was any kind of manufacture of soapstone objects in the town, or if the goods were transported here as finished products.

The chronological development of the presence and use of soapstone artefacts will be investigated. Particular attention is paid to the 131 soapstone objects from the stratified deposits which date from the period c. AD 800–900. Objects recovered outside of these contexts will, however, also be drawn into the discussion to a certain extent, as this gives general information on artefact-types and broadens the discussion based on the finds from the stratified deposits.

Because of the extent of later cultivation, intact deposits are preserved only over a smaller part of the settlement area, so that many artefacts from the whole settlement period have been found in the ploughsoil. However, the ploughsoil also contains small quantities of post-Viking-period material, such as pottery and baking stones, from a Late-medieval farm on the site. This complicates the dating of soapstone objects from the ploughsoil as many of the soapstone artefact-types had the same shape and appearance after the 10th century as in the Viking Period. However the vast majority of other types of object recovered from the ploughsoil are from the Viking-period settlement (Pedersen and Pilø 2007:186). This makes it very likely that the majority of the soapstone objects in the ploughsoil are from this period too.

Another objective is to investigate the place of origin of the soapstone products recovered. As there are no known soapstone quarries in Vestfold, the soapstone found at Kaupang is likely to have been imported from other areas.

Previous excavations at Kaupang, both in the cemetery and in the settlement area, have recovered a number of different soapstone objects. Most of the artefacts from the graves have already been published (Blindheim et al. 1981; Blindheim and Heyerdahl-Larsen 1995; Blindheim et al. 1999; Stylegar 2007), and form an important comparative assemblage for this study. I have gone through most of the vessels and supplemented the published information. The soapstone from the settlement excavations of 1956–1967 is currently being studied by Sigrid Kaland, Bergen Museum, and therefore could not be included here.

12.1 Soapstone artefacts of the Viking Period – previous research

The Viking Period saw extensive production of soapstone artefacts in southern Norway, especially vessels, and the items were distributed widely (Skjølsvold 1961; Resi 1979, 1987; Risbøl 1994). The first studies of soapstone artefacts date back to the 19th century (Rygh 1885; Helland 1893), and there are several publications from the earlier 20th century (Shetelig 1912a; Grieg 1933; Petersen 1951), mainly concerned with vessels.

A central study of soapstone vessels was published by Haakon Shetelig in 1912, where he presented a classification based on a comparison with vessels of other materials such as metal and pottery in order to establish a chronology. Even though Shetelig's work was based on few finds, it has formed the basis of almost all later works on the classification and dating of this material in Norway. Until the appearance of Lars Pilø's (1990) work "Early soapstone vessels in Norway", Shetelig's chronology in fact remained unquestioned. Based on more examples and the results from recent excavations, Pilø suggested a revision of Shetelig's chronology. Shetelig argued that soapstone production began in the Early Iron Age (500 BC) and continued into the Viking Period. Pilø argued (1990:89) that the production started earlier, in the Late Bronze Age, with the earliest find dated to 810–770 BC. However, Pilø also concluded that production did not continue to the Late Iron Age uninterrupted, as there is no evidence of the use or production of soapstone vessels in the centuries immediately prior to the Viking Period.

Arne Skjølsvold (1961) studied the large-scale production of soapstone vessels in southern parts of Norway in the Viking Period. Based on the size of the quarries and the uniformity of the vessels, Skjølsvold argued that a more or less industrial production of soapstone vessels was a feature of the Viking Period, and that vessels were important commodities with a wide distribution. His survey of the soapstone quarries has been important for the selection of quarries for provenance analysis in this study.

One of the larger and more recent analyses of soapstone artefacts from the Viking Period is Heid Gjøstein Resi's (1979) study of the material at Hedeby. She provided a detailed classification of all the different soapstone artefacts from the site. As the soapstone assemblage from Hedeby may have a Norwegian origin and shares many characteristics with that from Kaupang, it is suitable for comparative analyses and provides important reference material.

The most thorough investigation of the distribution of soapstone in Scandinavia in the Viking Period to date was published by Ole Risbøl in 1994. By including finds from settlements and burials in Norway, Sweden and Denmark, Risbøl attempted to shed light on the exchange of soapstone vessels in the Viking Period. His research indicates that male burials containing soapstone vessels belong to the upper stratum of society, and should be associated with Viking-period trade. According to Risbøl the export of soapstone to southern Scandinavia was connected to the Danish royal power's interest in the eastern part of Norway.

A recent study of soapstone artefacts from Shetland has been undertaken by Amanda Kate Forster (2004). Her research also sheds light on the trading of Norwegian soapstone goods during the Viking Period and the following period, as she includes soapstone artefacts from Norway and their distribution in the North Atlantic. She argues that the relatively low numbers of Norwegian goods in this region do not support the organized export of soapstone from Norway in the Viking Period. According to Forster the major mode of distribution of Norwegian soapstone in the North Atlantic region in the period AD 800–900 was travellers bringing soapstone items with them as personal possessions.

Studies of soapstone vessels from after the 10th century have been undertaken in relation to Borgund in Sunmøre (Lossius 1977) and Bergen (Vangstad 2003). These works provide important reference material when it comes to distinguishing post-Viking-age from Viking-period vessels.

Other categories of soapstone artefact, such as spindle-whorls, loomweights and sinkers, have received some attention in various recent research projects (Øye 1988; Tansøy 2001; Andersson 2003; Olsen 2004; Sørheim 2004; Øye, this vol. Ch. 13), and will be of consistent relevance to this study. Even though some of this material post-dates the 10th century, the objects represent important reference material, since the shape of these artefacts seems to have been quite similar both in the Viking Period and subsequently.

12.2 Classification

As a basis for this study, I have measured and described the physical properties of the soapstone artefacts. One should, however, bear in mind that the physical qualities of the stone may to some extent have affected the shape and attributes of the artefacts, making it less straightforward to base a classification on detailed measurements. Factors indicating use, such as the presence of burning or evidence of reworking, are also essential attributes recorded in this study, adding important information for the interpretation of the finds.

12.2.1 Vessels and vessel sherds

Soapstone has physical qualities that make it very suitable as a raw material for the manufacture of cooking pots. These vessels were an important part of household equipment in Viking-period Norway. Experiments using soapstone vessels as cooking pots have shown that it takes just a few minutes to bring the contents to the boil, while the vessel keeps them boiling several minutes after it has been taken off the heat, thus keeping food warm. Experiments also show that the vessels are easily cleaned after use, leaving no remains of the food, even with a rough interior surface (Østerås 2002:75).

Beyond their function as cooking pots, we know little about how the vessels were used, but it is reasonable to believe that they may also have functioned as containers. In the same way as soapstone can keep heat, it has the ability to keep cold. If soapstone vessels were cooled down they could keep the contents cold for a long time. This must have made the vessels very suitable as containers for food and drinks, even though no traces from such use are discernible today.

The three main vessel-types known from the

Figure 12.1 *Vessel-types of the Viking Period.* ***728:*** *C5718;* ***729:*** *C3866;* ***730:*** *C5584. (Scale 1:4). From Rygh 1885.*

Viking Period are *bowl-shaped vessels, trough-shaped vessels* and *vessels with a handle*. The first type is far the most common, but with variation in size, form and decoration (Petersen 1951:352; Skjølsvold 1961:15–17).

At Kaupang, no complete vessels have been recovered from the settlement area, but 448 sherds of vessels were found during the fieldwork of 1998–2003, which make out 55% of all the soapstone pieces from that fieldwork. From the stratified deposits assigned to SP I–III there are 58 vessel sherds, 44% of the soapstone pieces from these contexts. The difference in the percentages is probably due to the sieving of the settlement deposits, by which small fragments of objects other than vessel-fragments were more likely to be found than during fieldwalking.

Like most settlement assemblages, the soapstone material at Kaupang is heavily fragmented, and vessels are represented by small fragments. The majority of the sherds are 3–7 cm in length and only a handful are longer than 8 cm. The fragmented state of the material makes it difficult to identify the different vessel-types. The rim sherds and base sherds are, however, more useful for studying the range of vessel forms. 75 sherds, 17% of the 448 vessel-fragments, have been identified as rim sherds, but only two sherds as base sherds.

More or less complete vessels have been collected from graves at Kaupang, and also from some of the stray finds (possibly from graves) (Blindheim et al. 1981:catalogue; Blindheim and Heyerdahl-Larsen 1995; Stylegar 2007:catalogue). This provides important comparative material for the fragmented settlement assemblage. One may of course question whether the grave finds are representative of the vessels in daily use. One should also bear in mind that the majority of finds from the settlement date from the 9th century while the majority of graves containing soapstone vessels are dated to the 10th (Stylegar 2007:80–1). Nevertheless the vessels from the graves seem to represent typical Viking-period types, and parallels can be found in the settlement assemblage. Soapstone vessels and/or vessel sherds occurred in 37 graves (Stylegar 2007:catalogue), and the assemblage contains 31 more or less complete and reconstructed vessels and seventeen find-units with smaller sherds from one or several vessels. It has, however, not been possible to obtain complete information and measurements from all the finds, and therefore the number of objects used as a comparative material varies according to the elements being investigated.

The shape and size of the vessels

All of the vessels from the graves surrounding Kaupang are of the bowl-shaped type, although with differences in size, thickness, decoration, rim and base shapes (Blindheim et al. 1981:catalogue; Blindheim and Heyerdahl-Larsen 1995). The settlement assemblage looks similar. Most of the sherds seem to be from circular or oval vessels, probably of the bowl-shaped type, and there are differences in rim and base profiles, thickness and decoration.

Because of the fragmented state of the settlement assemblage, it is difficult to estimate the size of the vessels, and a comparison with the more or less complete vessels from the surrounding burials may be useful. The diameters of buried vessels (N=26) range from 20.7 to 30 cm, with 24.7 cm as the mean. This size is entirely congruent with vessels in general from the Viking Period, where the most common diameter has been estimated to be between 20 and 30 cm with an average of about 24 cm, although both smaller and larger vessels are known (Skjølsvold 1961:20; Resi 1979:129). Consequently, a diameter of 20–30 cm should be assumed for most of the vessels from the settlement area. The vessels recovered at Hedeby, on the other hand, are larger, with an average diameter of 31 cm, and the largest examples around 65 cm in diameter (Resi 1979:25–31 and 129). This may indicate that the Hedeby vessels were generally larger than the majority of vessels recovered in Norway and also at Kaupang. It is not clear why this should be. There is so far nothing in the material to indicate that the chronological difference between the settlement at Kaupang and Hedeby would explain it. Many of the graves containing soapstone vessels at Kaupang date to the 10th century (Stylegar 2007:103–27), and so coincide with the date of the soapstone imported to Hedeby (Resi 1979:111–12).

The height of the vessels also varies. The vessels from the graves (N=25) are 6.5–14.5 cm high, with a majority between 8 and 11 cm. The same size-range should be expected in the settlement assemblage.

Vessels and vessel sherds vary in thickness too. This is not just from vessel to vessel but even in different parts of the same vessel. The majority of the sherds recovered from the settlement area (c. 73%) are under 2 cm thick, while about 25% measure 2.0–2.9 cm. Only a handful of sherds are more than 3 cm thick. The thickness of the vessels and sherds from the graves also varies, in some cases by more than a centimetre on a single vessel between a thin rim and a thick base. The rim of these vessels and rim sherds (N=27) varies from 0.3 to 1.9 cm thick, and the thickness of a rim may also vary by as much as 0.6 cm on a single vessel. The walls seem to be a bit thicker than the rims, but only a couple of vessels/vessel sherds have been measured, showing variance of 1–2 cm in thickness. The thickest sherd recorded from the graves is a base sherd 2.2 cm thick, which may indicate that many of the sherds from the settlement over 2 cm thick are base sherds. At Hedeby, the thickness of the rim varies between 0.5 and 2.5 cm, with a majority less than 1.5 cm. Wall and base sherds are on average a little thicker (Resi 1979:24, 29 and 31–2).

The surface of the vessels

Nearly all the sherds from the settlement area have intact surfaces, but a few are so badly preserved that it is nearly impossible to ascertain whether the vessels were polished or not. Another problem is the degree of fragmentation. The small size of the sherds only rarely gives a good idea of the surfaces. Although these factors make the figures uncertain, 76% of the total amount of vessel sherds seems to have smooth and polished surfaces with only limited evidence of tooling. On some of these sherds only one surface is completely smoothed and polished while the other is less even with faint toolmarks. Which of the interior and exterior surfaces is smooth or less even varies. 6% of all sherds have a rather uneven interior, 2% an uneven exterior, while 8% of the sherds are uneven on both sides with faint toolmarks. Even when toolmarks are visible on one or both sides of these sherds, they have been polished to some extent. Only 3% of all the vessel sherds have rougher walls and were probably unpolished; four sherds (0.9%) have a rough interior, three sherds (0.7%) a rough exterior, and seven of the sherds (1.6%) have distinct toolmarks on both the exterior and the interior.

A comparison with the grave finds, both vessels and vessel sherds (N=31), shows that more than 90% of these have smooth surfaces, and examples with rougher surfaces are rare. Only one sherd and one vessel have been identified with rougher and uneven walls, but the latter may only appear coarse because of its state of preservation.

Generally, Scandinavian Viking-period soapstone vessels have smooth and polished surfaces, although some also have clear toolmarks. Polishing the vessels was probably done by using leather, sand or very fine crushed quartz or quartzite (Resi 1979:41), a technique that seems to have been used on the majority of vessels from Kaupang. Soapstone becomes dry and hard in the air, and it was probably necessary to soak the vessels before polishing. Several finds of unsmoothed vessels from bogs and rivers are probably evidence of this practice (Skjølsvold 1961:87 and 92). Because of the softness of the soapstone, used vessels would show wear, which may be seen in the form of rounding on the rim, the absence of toolmarks, or small cuts in the stone (Vangstad 2003:74). Wear could explain the faintness of the toolmarks on most sherds. Vessels with rougher surfaces should possibly be considered as having been little used. However the very faint evidence of tooling on most vessels and sherds suggests that the majority of the Kaupang vessels had deliberately been smoothed and polished. Hedeby also has a high preponderance (79%) of vessels with smooth surfaces, although sherds with unpolished surfaces are found there too (Resi 1979:41–4).

Four of the vessels from the graves at Kaupang have faceted sides. This is an uncommon phenomenon on Viking-period vessels, and is almost only found in southern Norway (Resi 1979:Abb. 128). However, a few similar sherds have been identified in Hedeby too (Resi 1979:41). It has not been possible to recognize faceting on any sherds from the settlement assemblage because of the fragmentary state of this material.

Traces of use

If the vessels were not thoroughly cleaned or polished after use, traces of use in the form of blackening or sooting, or other colour differences, can be observed. Soapstone can stand very strong heat, and it is possible to put the vessels directly on a fire without immediate risk of fracturing (Magnus 1963:99; Østerås 2002:75). Many of the Viking-period vessels also had iron handles that made it possible to hang them over a fire in the hearth. After repeated use, these vessels would get soot on the exterior.

More than 22% of the sherds have traces of exposure to fire, demonstrating their use in cooking, including 24% of the sherds from the stratified deposits. Amongst the vessels and sherds from the graves (N=30), about 70% bear signs of having been exposed to fire, meaning they probably were used as cooking pots before they ended up in the graves. 67% have soot on one or both sides and 13% of the vessels have the distinctive white colour of soapstone that has been exposed to heat. The vessels and vessel sherds from the graves are larger than the sherds from the settlement, so that the scope for observing these traces of use is greater with the grave finds than the settlement assemblage. This should be seen as an explanation of the difference in percentages between the graves and the settlement finds. Another explanation is the fact that the grave goods are probably personal items that had been used, while the settlement assemblage may include both used and unused objects, amongst which the latter may not represent personal possessions.

Signs of use are usually observed as a faint black colour – the remains of soot – most often on the exterior of the vessels and vessel sherds, although a few objects were sooted on the interior as well. Incrustation on the interior walls is mostly seen as a discolouration of the soapstone, usually grey or brown, but some vessels and vessel sherds have adherent residues several millimetres thick, being the remains of food that has been cooked in the vessels. Chemical analysis of the contents of soapstone vessels indicates the presence of carbohydrated food remains (Augdahl 1979:168–9), and shows clearly that soapstone vessels were used as cooking pots. At Kaupang some sherds with a rough and unpolished interior surface have soot or incrustation hereby showing that vessels with an unpolished interior surface were also used for cooking. This is also the case in the assemblage from Hedeby (Resi 1979:52). Earlier claims that vessels with a rough interior were not suitable as cooking pots (Skjølsvold 1961:92) thus seem to be unjustified. The finds also show that not all the vessels from Kaupang had deliberately been smoothed and polished before use.

Some of the vessel sherds show evidence of having been worked after having breakage: three sherds from the settlement (C52519/18613, C52519/21083 and C52516/1826) and four fragments from the graves show traces of secondary working. On most sherds this takes the form of modifications to the fractured areas. Some of the spindle-whorls, loomweights, sinkers and moulds recovered from the settlement area were also manifestly made from vessel sherds. Even though the finds are few, they indicate that the secondary working of soapstone vessels took place at Kaupang. This is discussed further below.

Base profiles

From the settlement area, only two sherds which preserve the base of the vessel have been identified. One (C52519/13187) has a flat base while the other (C52519/12896) may have a rounded base. Neither of the sherds is from a stratified context. It is, however, a general problem that base sherds are difficult to distinguish from sherds from the walls of the vessels, and several base sherds may be unrecognised in the collection. Wall sherds with very degraded external surfaces, as well as some of the thickest sherds from the settlement assemblage, could in fact be base sherds.

Parallels to both of the sherds identified can be found amongst the vessels from the surrounding burials. It has been possible to identify the shapes of the bases of 21 vessels, of which nine have a flat base and twelve a rounded one. These two distinct base profiles are found at Hedeby too, where again base sherds are difficult to identify and consequently are low in number (Resi 1979:33–4).

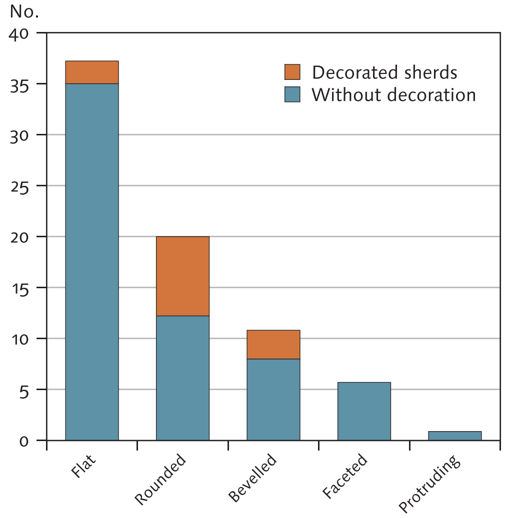
Rim-types

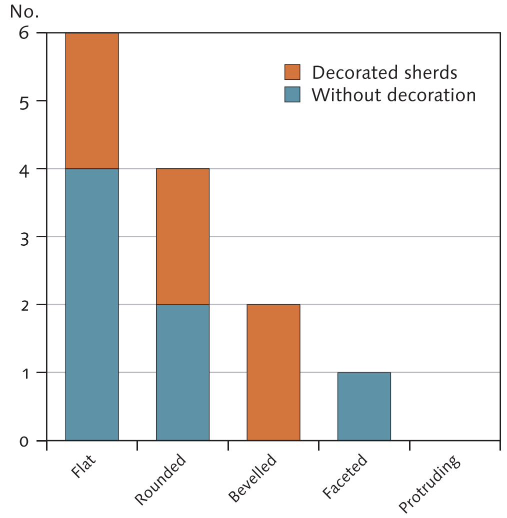
From the 448 vessel-fragments, 75 rim sherds have been identified, constituting around 17% of the collection of vessel sherds. The rims vary in shape, thickness and size. However five distinct types can be identified within the settlement assemblage: flat, rounded, bevelled, faceted and protruding types (Figs. 12.2, 12.5). All rim-types occur in several different thicknesses.

In the stratified deposits, rounded, bevelled, flat and faceted rims have been recorded – a total of 13 sherds, which constitute about 22% of the sherds from these contexts (Fig. 12.3). Amongst the grave goods, flat, rounded, protruding and bevelled rims have been identified (Fig. 12.4).

Flat rims

Half of the sherds recovered in the period 1998–2003 have a flat rim. This is the same with the sherds from the stratified deposits, albeit only 6 sherds, two of them from a single vessel. Conversely, amongst the grave goods, 76% of the vessels/sherds have flat rims, constituting the most common rim-form in the collection (Figs. 12.2–4). Because of the small number of rim sherds recovered from the settlement, we must be wary of drawing over-ambitious conclusions regarding differences between the two assemblages. Vessels with flat rims are quite common in the Viking Period in general, and the majority of





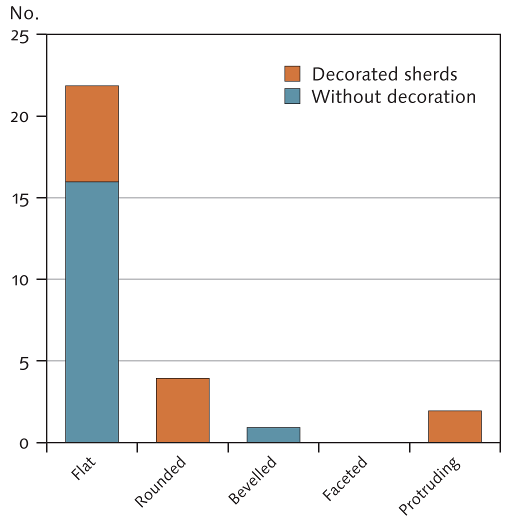


Figure 12.2 *Rim-types represented in the settlement assemblage.*

Figure 12.3 *Rim-types from the stratified deposits assigned to SP I–III.*

Figure 12.4 *Rim-types amongst the grave goods.*

these sherds from Kaupang are quite similar, both in shape and thickness, to the finds from Hedeby, where the flat rim also seems to be the most frequent type (Resi 1979:22 and 24). Most of the flat rims from Kaupang are similar to one particular type at Hedeby (Resi 1979:Abb. 9:10:1).

Rounded rims

About 27% of the rimsherds from the settlement area are rounded, and four sherds with a rounded rim were recovered from the stratified deposits. 14% of the vessels from the graves finds have a rounded rim (Figs. 12.2–4). The rounded rim is also common amongst the Hedeby finds. The rims from Kaupang can be subdivided into the three distinct sub-forms found at Hedeby (Resi 1979:Abb. 9:19:9, 9:20:11, 37:1 and 9:21:13). It is quite conceivable that the rounded shape of some of these rims is actually the result of wear during use. As already noted, the softness of soapstone means the stone wears down through use (Vangstad 2003:74). More or less complete vessels with rounded rims retrieved from the surrounding graves corroborate this. In three cases, the original rim-form seems to have been flat, but through use the rim has been worn down to a rounded shape in some areas.

Bevelled rims

About 15% of all the rims are bevelled (Fig. 12.2), and only two sherds recovered from the stratified deposits are of this type (Fig. 12.3). Parallels can be found at Hedeby. The largest group, eight sherds, are shaped like that in Resi (1979:Abb. 9:11:4): rims slanting upwards towards the interior side. Only one sherd with the bevelled type of rim has been found in a grave at Kaupang (Fig. 12.4).

Faceted rims

Only 8% of the rims are faceted (Fig. 12.2). Parallels to four of these rims have been recorded at Hedeby (Resi 1979:Abb. 9:23:17–18 and 9:25:21). Only one faceted rim sherd is from a stratified context in the settlement area and none has been found amongst the grave goods from Kaupang.

Protruding rims

Only one sherd from the settlement area, although not from a stratified context, has a protruding rim, and two vessels with a similar type of rim are known from the graves (Figs. 12.2, 12.4). Protruding rims are known from other Viking-period contexts (Shetelig 1912a:67–9; Petersen 1951:353 and 355). Significantly, perhaps, the protruding rim-type has no counterparts at Hedeby.

Decoration

About 17% of all rim sherds (N=13) were decorated with incised lines or grooves, but because of the

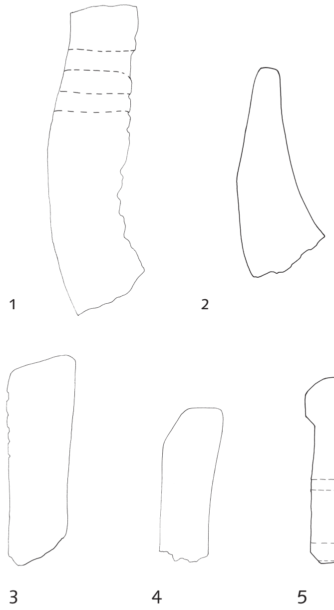
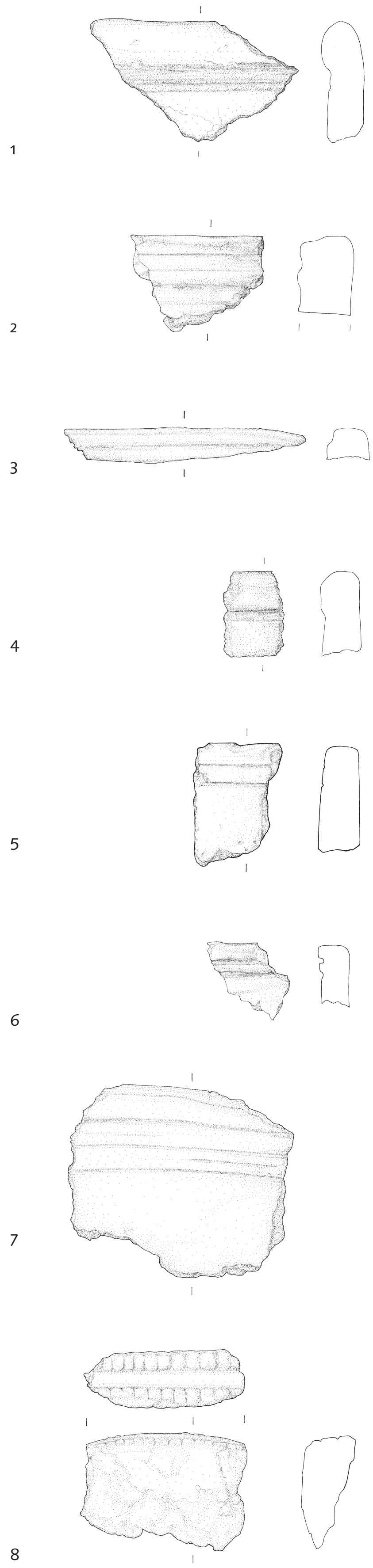


Figure 12.5 *The five rim types:* ***1:*** *flat (C52519/25379);* ***2:*** *rounded (C52519/19411);* ***3:*** *bevelled rim (C52519/19090);* ***4:*** *faceted (C52519/12709);* ***5:*** *protruding (C52519/10347). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 12.6 *Different forms of decoration on vessel sherds.* ***1:*** *One groove below the rim (C52519/10920);* ***2:*** *two grooves below the rim (C52519/1569):* ***3:*** *one line on the rim (C52519/16591);* ***4:*** *one line below the rim (C52519/18741);* ***5:*** *two lines on the rim (C52519/21505);* ***6:*** *two lines below the rim (C52519/12833);* ***7:*** *three lines below the rim (profile in Fig. 12.5.3) (C52519/19090);* ***8:*** *rim sherd with decoration on the rim top (C52517/2707). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

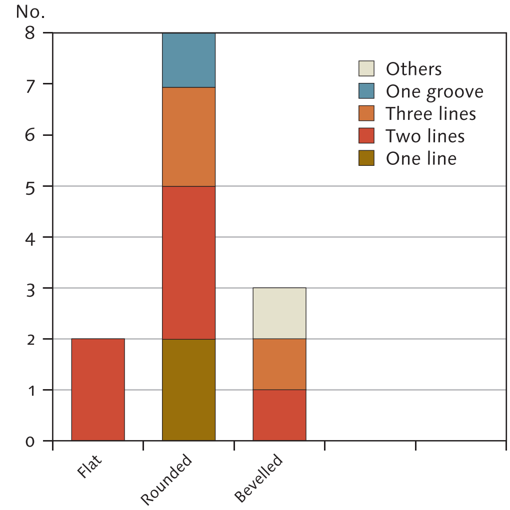


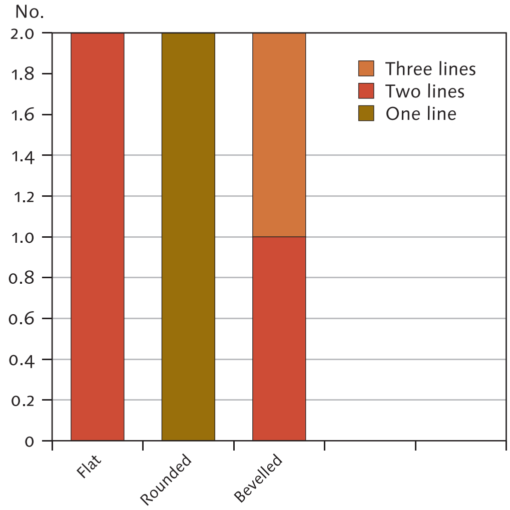
high degree of fragmentation and wear this should be considered a minimum estimate. Four further sherds without a rim but with similar decoration were also found, which may be from the rim area of the vessels. In the stratified deposits only six sherds are decorated (Fig. 12.8). Parallels have been found at Hedeby (Resi 1979:Abb. 9:11:4 and 37:1). A study of the graves goods reveals that 42% of the vessels/sherds from the burials were decorated. The most common decoration on both whole vessels and the sherds takes the form of incised lines and grooves below the rim (Figs. 12.6–9). This type of decoration is a common feature of Viking-period vessels generally (Skjølsvold 1961:18–19), although it seems to have been most common in eastern Norway (Resi 1979:fig. 126).

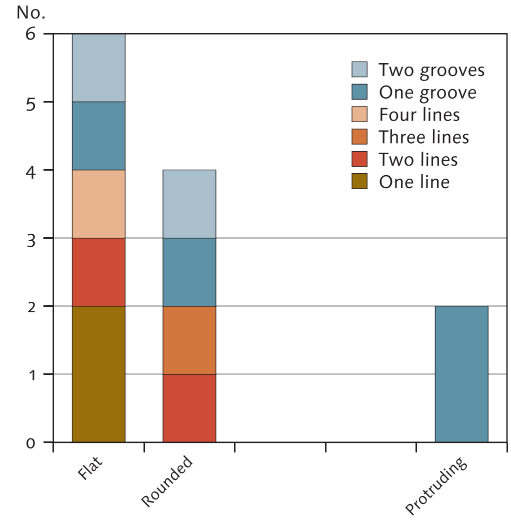
Figure 12.7 *Forms of decoration with various types of rim sherd in the settlement assemblage.*

Figure 12.8 *Form of decoration on vessel sherds from the stratified contexts assigned to SP I–III.*

Figure 12.9 *Forms of decoration on sherds and vessels from the cemetery assemblage.*







One rim sherd of the bevelled rim-type (C52517/2707) has a different type of decoration represented by incised lines and squares on the rim top (Fig. 12.6). The latter is not known as a form of decoration neither for Viking-period vessels nor on vessels from later periods. The sherd in question was found in a disturbed deposit and may be of a later date.

Repair or handle?

Typical of many of the bowl-shaped vessels of the Viking Period is an iron handle attached with a cramp iron on either side of the vessel (Petersen 1951:357; Skjølsvold 1961:20–1). This handle was used to suspend the vessels over the hearth and for carrying. On post-10th-century vessels this feature is less common (Vangstad 2003:29), and the type of handle could be an indication of the date of the vessel. Five principal forms of iron cramp are known from the Viking Period (Fig. 12.10; Skjølsvold 1961:23), but it is rare for the cramp iron and the handle itself to survive. On most vessels and vessel sherds, perforations below the rim, sometimes with traces of iron, are the only indication of a handle having been present. This is the case with the Kaupang settlement assemblage.

There are 24 nearly complete vessels amongst the grave goods, all of them with the remains of a handle (Fig. 12.14). 63% have remains of iron cramps and 25% also have remains of the handle itself. On the remaining 12%, only the perforations are left. This may indicate that vessels with handles were the most common vessel-type at Kaupang. A majority of these had a flat rim (Fig. 12.14).

Repairs on soapstone vessels are a common feature, indicating that these objects had a certain value. Repair was carried out by drilling through the vessel's body and using iron straps to bind the fragments together. Even though on a few sherds there are traces of iron in some of the holes, the state of preservation is so poor that it is difficult to determine if these are the remains of iron cramps for handles or iron straps for repairs. Some sherds have an incomplete hole, which could be evidence of an

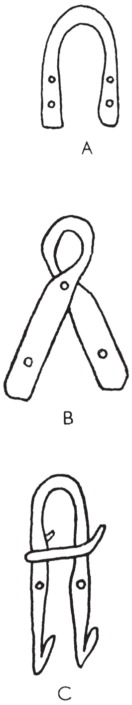


Figure 12.10 *Different types of iron cramp. From Skjølsvold 1961.*

Figure 12.11 *Evidence of repair on vessels from the cemeteries;* ***1:*** *from grave Ka. 298;* ***2:*** *from grave Ka. 292. Photo, Eirik Irgens Johnsen, KHM.*

Figure 12.12 *Rim sherd with remains of the iron cramp (C52516/220). Photo, Eirik Irgens Johnsen, KHM.*

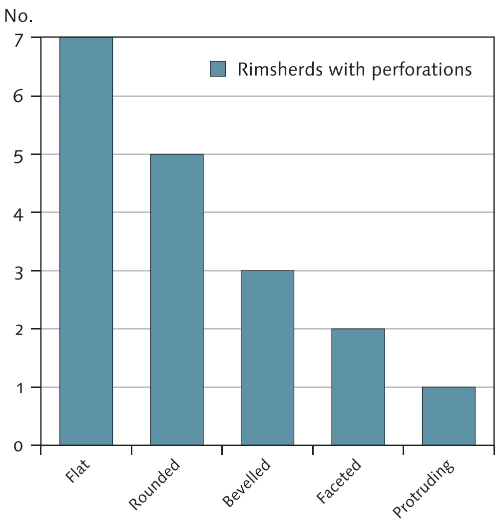
unsuccessful attempt to repair the vessels. Eight vessels from the graves have traces of repair. On most of these vessels only the perforations are visible, but on three vessels the iron straps, and in one case also a piece of soapstone used in the repair, survive (Fig. 12.11).

Altogether, 97 of the sherds from the settlement (21%) have perforations. Eighteen of the sherds have holes just below the rim, representing only 4% of all the vessel sherds, and the location of these perforations suggests that these were holes for iron handles. Most of these sherds have flat or rounded rims (Fig. 12.13). Only one of the sherds (C52516/220) has remains of the cramp itself (Fig. 12.12). However a few iron cramps which may have come from soapstone vessels have been recorded at Kaupang. At Hedeby about 25% of the sherds have perforations, and most of these are thought to be for handles because of their position by the rim (Resi 1979:35).

Vessel sherds from the stratified deposits in the settlement area

A total of 58 sherds has been recovered from the stratified deposits in the settlement, about 13% of all the vessel sherds. Of these, 25 can be assigned to SP II, c. AD 805/810–840/850, and 15 to SP III, c. 840/850–900. 18 sherds from the stratified deposits are not allocated to a specific Site Period (Tab. 12.2).

Characteristic of the majority of the 58 sherds is a smooth surface, with only weak toolmarks on some of the fragments. Three sherds, however, appear to have unpolished walls. As already noted, 24% of the



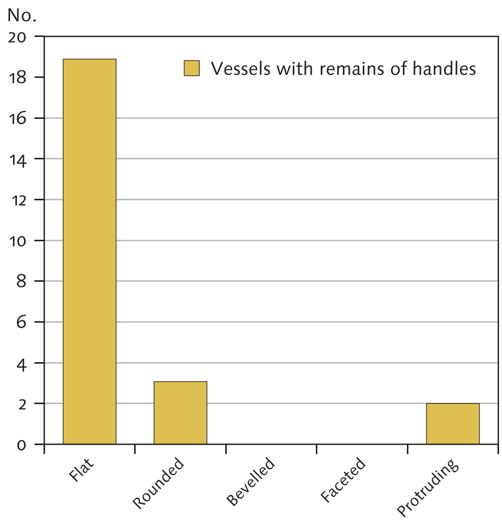


Figure 12.13 *Rim-types with perforations, possible for handles.*

Figure 12.14 *Vessels from the cemetery assemblage with remains of handles*

Site Period	Sub-phase	Plot	Number of finds	
SP I (c. AD 800–805/810)	-	-	-	-
SP II (c. AD 805/810–840/850)	-	1A	1	2%
	1	2A and 3A	10	17%
	2	2A, 3A and 3B	14	26%
SP III (c. AD 840/850–900)	-	1A, 3A and 3B	15	26%
Deposits from the 9th century not assigned to a Site Period	-	-	18	29%
Total	-	-	58	100%

Table 12.2 *Vessel sherds from SP I–III.*

Inventory no.	Remarks	Plot	Sub-phase	Context
C52519/25525	Smooth surface.	1A	-	Midden deposits, possibly from the fire place in structure A200.
C52519/27664 (6 sherds)	6 sherds from the same vessel. Smooth.	2A	1	Midden deposits.
C52519/18867	Smooth, soot on the exterior surface, one hole.	2A	1	-
C52519/24134	Smooth, weak toolmarks.	2A	1	Midden deposits in plot-division ditch.
C52519/27720	Smooth.	2A	1	Midden deposits.
C52519/26560	Coarse surfaces, incrustation on the interior side, one hole.	3A	1	Building A304.
C52519/16591	Rounded rim with one decorative line. Polished.	2A	2	Midden deposits.
C52519/18781	Smooth.	2A	2	Midden deposits.
C52519/18752 (4 sherds)	Soot on the exterior surface on two sherds, including incrustation on the interior surface on one sherd. Hole in one of the sooted sherds.	2A	2	Midden deposits.
C52519/18741	Rounded rim with one decorative line. Soot on the exterior surface.	2A	2	Midden deposits.
C52519/19411	Rounded rim. Brown discolouration on the interior surface.	3A	2	Midden deposits/pit in building A302.
C52519/21662	Smooth.	3A	2	Building A302.
C52519/21083	Flat rim. Traces of secondary working.	3A	2	Building A302.
C52519/28179	Flat rim and 2 incised lines below the rim. Soot on the exterior surface.	3A	2	Midden deposits.
C52519/19067	Bevelled rim. 2 decorative lines. Smooth.	3B	2	-
C52519/19090	Bevelled rim. 3 decorative lines.	3B	2	-
C52519/28207	Smooth.	3B	2	Deposits above Building A301.

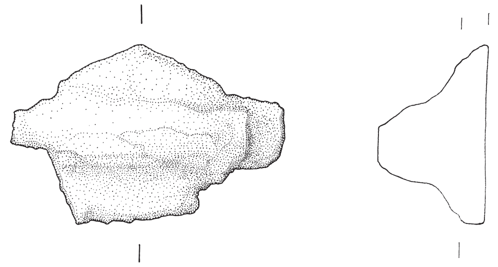
Table 12.3 *Vessel sherds from SP II.*

sherds show traces of burning and/or incrustation, indicating that they are from domestic vessels , most likely cooking pots. Two sherds bear evidence of having been reworked after breakage.

Site Period II
(c. AD 805/810–840/850)
Soapstone vessels were introduced along with permanent settlement in SP II, from AD 805/810, and this is the period with the highest number of finds. 25 sherds have been found in deposits on four different plots (Tab. 12.3). Seven of the sherds (28%) have clear evidence of use, such as soot, incrustation or discolouration, indicating their function as cooking pots.

The high proportion of sherds (N=18) recovered from the midden deposits on the plots is striking (Tab. 12.3), but this is most likely the result of quite normal site-formation processes. Broken artefacts of a certain size, such as vessel sherds, would more easily be removed from houses and activity areas and deposited in midden areas while smaller artefacts would more often be trampled into the floor and activity deposits. Only four of the 25 sherds were found inside a building. The sherds in question were located on plot 3A in structure A302 and A304. Traces of use have been observed on two of these sherds and traces of secondary manufacture on another (Tab. 12.3), linking them to domestic activities and some sort of manufacture within the houses. The sherds are 6.5–9.4 cm in length, with thicknesses of 1.9, 2.3 and 2.8 cm. Except for the two largest, these are of a size consistent with the majority of sherds recovered from midden deposits.

Figure 12.15 *Remains of a soapstone handle (C52519/25126). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*



Site Period III, intact deposits
(c. AD 840/850–900)
The only archaeological features from SP III are pits dug through older deposits. The fill in these pits is thought to be a little later than SP II, but earlier than AD 900 (Pilø and Skre, this vol. Ch. 2:25–6).

Seven vessel sherds were recovered from two different pits on plot 1A, SP III (Tab. 12.4). Both pits are originally from SP II, but were re-dug in SP III, and the soapstone finds were found in deposits related to this later phase.

Eight vessel sherds were recovered from three different pits on plots 3A and 3B, SP III (Tab. 12.4). The pits in question were filled with waste but their original function is unknown. Three of the sherds bear clear signs of having been used as cooking pots. One of the sherds found in a pit on plot 3B is the

Inventory no.	Remarks	Plot	Context
C52519/27482	Incrustation on the interior side, soot on the outside. Polished.	1A	Deposits in the bottom of pit A64891.
C52519/18629 (2 sherds)	2 sherds with smooth surfaces.	1A	Deposits in pit A64891.
C52519/18613 (2 sherds)	2 sherds, one with possible traces of secondary working.	1A	Deposits intentionally placed on top of pit A65132.
C52519/25379 (2 sherds)	2 sherds, one with a flat rim and two holes. Smooth, but one sherd has a rough interior surface.	1A	Deposits intentionally placed on top of pit A65132.
C52519/25919	Exposed to heat. One hole with an iron rivet. Smooth surfaces.	3B	Deposits in pit A43852, possibly used for refuse.
C52519/25758 (2 sherds)	2 sherds with smooth surfaces: one has been exposed to heat.	3B	Deposits in pit A43852, possibly used for refuse.
C52519/25126	Handle.	3B	Midden deposits in pit A43852.
C52519/12231 (2 sherds)	Rim sherds with flat rim that fit together.	3B	Deposits in pit A43842.
C52519/23876 (2 sherds)	2 sherds, one with rough surfaces. The smooth sherd has incrustation on the interior surface.	3A	Deposits in the midden pit A65446.

Table 12.4 *Vessel sherds from SP III.*

Inventory no.	Remarks	Plot	Context
C52519/19319	-	2A	Deposits in a possible posthole, A65526.
C52519/12028	-	4B	Activity deposits.
C52519/12021	-	4B	Activity deposits.
C52519/11825	Smooth with remains of a hole, exposed to heat.	-	-
C52519/12056	Smooth.	-	-
C52519/12220 (2 sherds)	One rim sherd of a rounded rim, smooth on the exterior and uneven on the interior. The second sherd is smoother.	-	-
C52519/11510	Uneven. Remains of two holes.	-	-
C52519/11524	Rim sherd of a flat rim with two incised lines below the rim.	-	-
C52519/1627	Smooth, but with some toolmarks in the interior.	-	-
C52519/1705	Smooth exterior, uneven interior surface.	-	-
C52519/1743 (2 sherds)	Smooth. Remains of a hole on one sherd. The sherds fit together.	-	-
C52519/27395	Smooth.	-	-
C52519/28706	Smooth.	-	-
C52519/12709 (2 sherds)	Smooth. One rim sherd of a faceted rim.	-	-
C52519/19784	Soot on the interior surface. Smooth.	3/4	Midden deposits in plot-division ditch.

Table 12.5 *Vessel sherds from SP I–III.*

remains of a soapstone handle (Fig. 12.15), a type usually found in post-10th-century contexts (Lossius 1977:20; Vangstad 2003:29–31). Two similar sherds have, however, been found at Hedeby (Resi 1979:38). Soapstone handles are common on the trough-shaped type of vessel of the Viking Period, but those handles are usually larger than C52519/25126. The sherds from Kaupang and Hedeby may indicate that this type of handle can occur earlier than previously thought.

Eighteen sherds were recovered from stratified deposits of the 9th century without association with a specific Site Period. Three of these sherds had been exposed to fire, indicating their place in cooking pots (Tab. 12.5).

12.2.2 Spindle-whorls

The spindle-whorls have been analysed as a group by Ingvild Øye (this vol. Ch. 13:340–7) in her study of the textile-production equipment, and I shall only summarise here certain points relevant to the interpretation of the soapstone assemblage as a whole.

At Kaupang, 34 spindle-whorls of soapstone were recovered during the archaeological fieldwork from 1998–2003, constituting about 28% of all the spindle-whorls found (N=121). Six different forms of soapstone whorl are recorded: (A) hemispherical upper part and flat base; (B) with a rounded base, giving a convex curve in the cross-section – nearly biconical in shape but more rounded; (C) conical; (D) lentoid or biconical; (E) flat with straight sides; and (F) flat with rounded, slightly convex sides (Øye, this vol. Ch. 13:Fig. 13.3). The majority of the soapstone spindle-whorls are hemispherical and flat, and the choice of material is determinative of the shape of the whorl (Øye, this vol. Ch. 13:343, Tab. 13.1).

The hemispherical form appears to be the most common for soapstone whorls in Norway (Petersen 1951:302; Skjølsvold 1961:30). At Hedeby, on the other hand, the majority are flat. Resi has porposed that this is the most convenient form for secondary production from vessel sherds (1979:78 and 85). The same explanation should be considered for many of the Kaupang whorls, even though only one flat whorl (C52518/17216) is sooted and so shows clear traces of being made from a vessel sherd. Amongst the 34 soapstone spindle-whorls were three unfinished specimens (C52516/560, C52516/4293 and C52519/18484), one of them a re-used vessel-fragment. This is clear evidence that soapstone whorls were produced at Kaupang. Some of the finished soapstone whorls also bear witness to unskilled manufacture. Two have an uneven shape, and three have holes that are not perfectly centred. This should probably be seen as evidence of production by non-specialists, and very probably by inhabitants of the town. It may also explain why these were discarded. The two whorls of uneven shape (C52519/10431 and C52519/11572) are also very light (between 3 and 7 g), and thus can hardly have been much good for spinning. They are therefore omitted from further analysis by Øye (this vol. Ch. 13:344–5).

Inventory no.	Description	Plot	Site Period	Context
C52519/23482	Hemispherical, type A. Two small cuts on the upper side.	2A	SP I	Outdoor activity layer or midden deposit.
C52519/18484	Hemispherical, type A, but unfinished.	2A	SP II:2	-
C52519/21705	Hemispherical, type A, but assymmetrical.	3A	SP II:2	Possibly dug out of plot-division ditch.
C52519/11353	Fragment.	3/4	SP II:2	Plot-division ditch between plots 3 and 4.
C52519/17216	Flat, type F. Soot on the underside indicates the secondary working of a cooking pot.	1A	SP III	Deposits from pit A64891.
C52519/9709	Flat, type F.	-	SP I–III	-

Table 12.6 *Spindle-whorls of SP I–III.*

In Norway generally, the majority of spindle-whorls were made of stone, preferably soapstone (Petersen 1951:304). From the settlement area at Kaupang only 28% of the whorls uncovered during the fieldwork of 1998–2003 are of soapstone. The proportion amongst the grave goods, however, is a little higher (33%) (Øye, this vol. Ch. 13:367).

Spindle-whorls from stratified deposits

Only six soapstone spindle-whorls have been recovered from deposits dated c. AD 800–900. None of the whorls were found in connexion with houses or workshops (see Tab. 12.6). The shape and size of spindle-whorls stayed very much the same in the Viking Period and from the 10th century into more recent times (Skjølsvold 1961:30; Øye 1988:37), so that any dating based on typological criteria is difficult.

Figure 12.16 *Loomweight or netsinker (C52167/10). (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.*

It is interesting to note that the hemispherical whorl recovered from plot 2A, SP I, c. AD 800–805/810, is the only soapstone object related to the initial settlement phase at Kaupang (Tab. 12.6). It is also the only spindle-whorl from SP I (Øye, this vol. Ch. 13:351–2). Parallels to this whorl have been found at Hedeby (Resi 1979:Abb. 74:6). There are, however, some indications that the dating to SP I is uncertain (Øye, this vol. Ch. 13:353–5; Pilø, this vol. Ch. 10:287), and the date of the whorl may be doubted. The recovery of loomweights from SP I on plots 1A, 2A and 2B may be seen as evidence of buildings, from at least seasonal settlement (Øye, this vol. Ch. 13:353). Therefore the possibility of these objects, both the spindle-whorl and the loomweights, in fact representing SP II should be considered.

Two, possibly three, of the four whorls related to Site Periods can be seen as evidence of the manufacture of soapstone whorls. An unfinished spindle-whorl was found on plot 2A, SP II:2, and is clear evidence of the production of soapstone whorls in the early 9th century. A second whorl, recovered from plot 1A, SP III, has remains of soot on one side, indicating that it was made from a vessel-fragment (Tab. 12.6). This whorl was recovered from a pit originally of SP II, which was re-dug in SP III. The spindle-whorl was found in deposits related to the later activity. A whorl recovered from plot 3A, SP II:2 has an uneven shape and a light weight and so was not an efficient item of spinning equipment. Some of the whorls of uneven shape may, as stated above, be an indication of domestic production, as such items would very probably not have been imported to the site.

12.2.3 Loomweights and netsinkers

Only four weights of soapstone recovered from Kaupang during the fieldwork of 1998–2003 have been identified as loomweights or netsinkers (Fig. 12.16; C52264/30, C52167/10, C52516/682 and C52516/2729) (Øye, this vol. Ch. 13:347). These weights were made either of a raw piece of soapstone or of vessel sherds, with no forming other than the

Inventory no.	Description	Weight	Context
C52516/3798	Oval linesinker with grooves for lines on both the long sides, which cross on the short sides. A hole drilled in both ends.	500 g	Deposits from the 9th century
C52519/15002	Flat pointed-oval linesinker with convex sides. Three line holes, one at either end and one in the middle on the broader side. An incised groove lengthwise between the three holes.	70 g	-
C52519/16598	Drop-shaped linesinker with one groove for a cord on each of the broader sides.	86 g	-
C52516/3795	Semicircular linesinker. Secondarily produced from a broken cooking pot with soot on one side. Flat rim.	97.3 g	-
C52516/1598	Possibly a sinker with a hole in one end.	3.6 g	Deposits from the 9th century
C52516/1872	Possibly an unfinished sinker with an incomplete hole at the broadest end.	2.3 g	-

Table 12.7 *Weights identified as linesinkers.*

perforation of the stone. This makes it difficult to specify the function of the objects. They could be either sinkers for fishing nets or loomweights: we are not able to determine whether they were used on land or at sea. Despite the fact that the problem of identification has been discussed by several different archaeologists (Øye 1988; Hagen 1994; Sørheim 1997, 2004; Olsen 2004), we still lack clear criteria for distinguishing the two artefact-types. We should perhaps allow for the same type of weights to have been used both on land and at sea according to need. If so, we will never be able to tell them apart.

None of the four weights was found in a stratified deposit from the 9th century. Unfortunately, the shape of loomweights and netsinkers was more or less the same after the 10th century as in the Viking Period (Øye 1988), and they occur in both rural and urban contexts. This makes the dating of the soapstone weights difficult. Two of the weights recovered (C52264/30 and C52167/10) are re-used rim sherds. One of the rim sherds has linear decoration below the rim, as well as holes for a handle, which probably indicate a Viking-period date.

The majority of loomweights from the settlement at Kaupang were made of clay, and soapstone was seldom used (Øye, this vol. Ch. 13:347 and 349). A general survey of Norwegian finds from the Viking Period reveals that loomweights were made of stone, preferably soapstone, more often than of clay (Petersen 1951:295–6). However, the majority of these finds are from graves and so cannot be directly compared with the settlement assemblage at Kaupang. Only one loomweight (of unrecorded material) has definitely been found in a grave at the Bikjholberget cemetery (Ka. 283; Blindheim et al. 1995:83), while there are remains of two fired clay loomweights found as stray finds in the same cemetery, possibly from graves (Stylegar 2007:126–7; Øye, this vol. Ch. 13:350).

12.2.4 Linesinkers

Unlike netsinkers, linesinkers can be identified by shape. Linesinkers were used for weighing down the line, bait and fishhook while fishing, and the sinkers therefore usually have shapes suitable for movement in water (Olsen 2004:26; Sørheim 2004:118–19). They would also be of various weights according to different fishing techniques and the depth and currents where the fishing took place (Olsen 2004:26).

Six of the soapstone weights from Kaupang have been identified as sinkers from their shape. Four of them are linesinkers, while the other two are less certain (see Tab. 12.7). Soapstone was not the only material used for such objects. Eight sinkers (57%) were made of other types of stone.

The six soapstone sinkers are quite diverse, in both appearance and weight (Tab. 12.7). Most of them were quite simply made, but the shape of one of the objects (C52516/3798) implies a need both for skill and technique in production. The intended function of the holes at either end is uncertain. Ethnological material from Norway and Shetland has documented that some linesinkers had a stick inserted into such holes in order to keep the hooks clear of the line. The same function has been suggested for linesinkers recovered at Bryggen in Bergen from around the 12th century onwards (Olsen 2004:56–63 and 72–7), and may also be attributed to this sinker from Kaupang. Another linesinker (C52516/3795) has a semicircular shape typical of sinkers used for trawling, with the line dragged through the water behind the boat (same shape as Olsen 2004:fig. 19). In this employment, it is important to stop the line twisting, which is achieved by using an asymmetrical sinker. The suspension holes, one at each end, are placed in such a way as to obtain balance when the line is dragged through the water (Sørheim 2004:119).

Two of the linesinkers bear witness of manufacture at Kaupang, and one was probably made from

Inventory no.	Diameter	Diameter of the hole	Evidence of use
C52519/18852	7.4 cm	1.7 cm	Exposed to heat; no slag.
C52516/1709	15.5 cm	-	Exposed to heat, traces of slag.
C52516/1691	13.8 cm	1.9 cm	-
C52519/28418	11.6 cm	2.7 cm	-
C52516/5780	15.2 cm	2.3 cm	Exposed to heat, traces of slag.
C52516/150	14.8 cm	-	-

Table 12.8 *Complete tuyères and large tuyère-fragments.*

a vessel-fragment (Tab. 12.7). Sherds with traces of secondary working have also been recovered from the graves, and Charlotte Blindheim has suggested that they were used as sinkers (Blindheim and Heyerdahl-Larsen 1995:80).

Sinkers from the stratified deposits

Only two of the sinkers were found in stratified contexts of the 9th century (Tab. 12.7). Both objects were found during the CRM excavations, and it is, consequently, impossible to assign the finds to a specific Site Period.

The shape of sinkers was more or less the same after the 10th century as in the Viking Period (Olsen 1998:24–32; Tansøy 2001:52), and these artefacts were used in both rural and urban contexts. This makes the dating of the remaining four sinkers from the later medieval and the modern plough-layer difficult.

12.2.5 Tuyères

Eighteen fragments and six more or less intact tuyères made of soapstone were recovered from the settlement area during the fieldwork of 1998–2003. These must be associated with crafts using high temperatures, such as metalworking or glass-bead production.

A tuyère is a piece of stone with a tubular hole through which air was blown into the forge (Fig. 12.17). Most of the eighteen fragments from Kaupang are quite small, with dimensions between 2 and 6 cm, which makes it impossible to identify these pieces of soapstone as tuyères solely by shape. Characteristic of all of these fragments is that they bear signs of having been exposed to strong heat and also have traces of slag. The six more or less intact tuyères are coarsely made of a raw piece of soapstone with a perforation towards the middle, although not always in the centre.

The fact that soapstone can stand very strong heat without cracking makes it suitable raw material for tuyères. These artefacts are exposed to great heat in the forge. At Dorestad, X-ray diffraction on tuyères has demonstrated that temperatures from 700°C to more than 1450°C were reached (Kars and Wevers 1983:169–70 and 180). When soapstone is exposed to such heat it turns a distinctive white colour, making it possible to identify used from unused objects.

Three of the objects identified as tuyères have no clear traces of use (Tab. 12.8, Fig. 12.17.3, 4 and 6). They have been interpreted as unused tuyères because of an approximately tubular perforation in the middle. A parallel to one of these objects has been found at Hedeby, where only one unused tuyère is recorded (Resi 1979:Abb. 64). It is possible that the three unused tuyères were goods either for use in Kaupang or for further export. With the lack of evidence of use, however, we must note the possibility that the objects in question actually had a different function. They could have been used as weights, either loomweights or netsinkers.

It is very difficult to estimate the quantity of tuyères in use from the fragments alone.

Find-number	Site Period	Plot	Context
C52519/18852 (intact tuyère, see Tab. 12.13)	SP II	1A	Midden deposits north of building A200.
C52519/20553	SP II	1A	Fill in plot-division ditch between plots 1A and 2A.
C52519/25498	SP II	1A	Midden deposits east of plot 1A, possibly from the fire place in building A200.
C52519/19301	SP II:2	2A	-
C52519/21034	SP II:2	3A	Activity layer in building A302.
C52516/5456	SP I–III	-	-

Table 12.9 *Tuyères and tuyère-fragments from SP I–III.*

Figure 12.17 *Tuyères from Kaupang, front (upper) and back (lower). Dimensions, see Table 12.8 (**1–6:** C52519/18852, C52516/1709, C52516/1691, C52519/28418, 52516/5780, C52516/150). Photo, Eirik Irgens Johnsen, KHM*

Nevertheless, the finds bear witness to productive activities requiring a high temperature, and, except for the three unused tuyères which might be regarded as trade goods, the objects can be associated with crafts practised on the site. The majority of this artefact-group consists of very small fragments, indicating that the objects were intensively used. The tuyères were used repeatedly until the stone cracked into small pieces. The same phenomenon has been observed at Hedeby (Resi 1979:68).

Tuyères from the stratified deposits

Five fragments and one intact tuyère were recovered from stratified deposits dated to the first half of the

Inventory no.	Type of block	Length of the block	Thickness of the block	Cavities for	Evidence of use
C52516/1703	?	7.1 cm	2.2 cm	5 ingots	-
C52516/5782	Re-used vessel sherd	8.1 cm	1.8 cm	4 circular depressions	-
C52519/965	?	4.3 cm	1.9 cm	1 ingot	Brown discolouration in the mould.
C52519/12633	Re-used vessel sherd?	3.8 cm	1.8 cm	1 ingot	Exposed to heat.
C52519/14971	?	3.8 cm	?	2 ingots, 1 possible blank	Gold droplets.
C52519/17192	Re-used vessel sherd?	3.7 cm	1.3 cm	1 ingot	Exposed to heat.
C52519/9858	?	5 cm	2 cm	1 ingot	Brown discolouration in the mould.
C52519/29063	?	5.5 cm	1.4 cm	1 ?	-
C52519/29064	?	1.9 cm	0.7 cm	1 ?	-

Table 12.10 *Moulds. (After Pedersen, in prep. with additions).*

9th century. Four of the fragments and the intact tuyère are from SP II on three different plots, dated c. AD 805/810–840/850, while one fragment cannot be assigned to a specific Site Period as it was recovered in the CRM excavation (Tab. 12.9). The intact tuyère has been exposed to heat, but has no traces of slag, which may indicate use in glass-bead production rather than metalworking. All the smaller fragments recovered have traces of slag.

Characteristic of all the finds is that they were recovered from midden deposits on the different plots. The single exception is a fragment found in an activity layer in building A302 on plot 3A (Tab. 12.9), which is to be associated with metalworking on this plot even though it is unlikely that this was actually carried out inside the building (for a different view, see Skre, this vol. Ch. 15:380 and 385–6). Micromorphological samples from the activity layers inside the building do not suggest that metalworking or glass-bead production took place there (Milek and French 2007:347–52).

12.2.6 Moulds

Several moulds found are left from metalworking. The moulds are important evidence for the types of item actually cast here.

Nine soapstone moulds have been found in the settlement area. Six of these moulds are for ingots and three – possibly four – may have been used for casting other objects (Tab. 12.10, Fig. 12.18) (Pedersen, in prep). Unfortunately, nine of the moulds are damaged, and only one (C52516/5782) is preserved entire with the form intact.

Some of the moulds show traces of use. On one mould several gold droplets are visible in and around the cavity for the possible blank, proving that it was used to cast objects of gold. The majority of the soapstone moulds are small, with just one cavity, but three moulds have several grooves or depressions, indicating more intensive use of the objects (Tab. 12.10).

Only one of the moulds can securely be identified as a re-used vessel sherd. A second mould is covered with soot and two more have also been exposed to heat, which may indicate the re-use of vessel-fragments (Tab. 12.10). For the rest of the moulds recovered during the fieldwork of 1998–2003 it can be quite difficult to determine whether they are made from primary blocks or are the result of secondary production from vessel sherds. There is no clear evidence for the latter, but it cannot be excluded. The thickness of the moulds, from 0.7 to 2.2 cm, makes it possible that they are made from vessel sherds. Finds from the earlier excavations at Kaupang also include soapstone moulds made of broken artefacts: both vessels and, possibly, a sinker (pers. comm., Sigrid Kaland). Many of the moulds recovered at Hedeby also seem to be made of reworked soapstone artefacts (Resi 1979:58).

None of the soapstone moulds was recovered from a stratified context dated to the 9th century. It is, however, highly likely that the moulds actually are of the Viking Period, as the casting of ingots is not known to have taken place in rural contexts such as that of Kaupang after the 10th century.

12.2.7 Unclassified object and fragments

Only one small object (C52519/16464) recovered from the settlement area does not belong to any of the other, more common, soapstone artefact-types. This is a small rectangular piece of soapstone with a perforation at one end. It is 1.2 cm long and only 0.5 cm in width. The function of the object is unknown, but both the shape and size render it likely that it was a pendant. No parallels to the artefact are known from other sites as far as I am aware.

More than 280 unclassified fragments of soapstone, most of them very small (<5 cm), were recovered. This constitutes about 34% of all pieces of soapstone (N=806). As already noted, small fragments of soapstone lacking distinct signs of having been worked can be difficult to spot in the course of

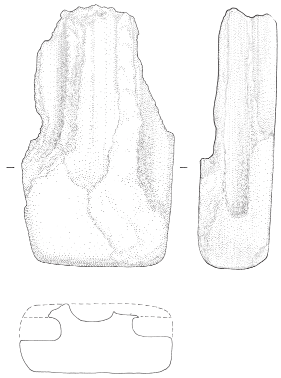


Figure 12.18 *Soapstone mould with grooves for 5 ingots (C52516/1703). (Scale 1:2). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 12.19 *Unclassified object. (Scale 2:1). Photo, Eirik Irgens Johnsen, KHM.*

either excavation or fieldwalking, and may therefore be under-represented.

Altogether 59 fragments have been recovered from the stratified deposits dated to the 9th century. Thirty-five fragments are from SP II, five fragments from SP III, and nineteen fragments are from the 9th-century deposits but not a specific Site Period. No soapstone fragments were recovered from SP I.

The majority of the finds are recovered from midden deposits on the different plots. The exceptions are two fragments associated with buildings on plot 2A, SP II:1, and on plot 3A, SP II:2, respectively.

About 24% of the fragments from the 9th-century deposits show clear signs of having been worked, and are the products of some sort of manufacture of soapstone objects. Five of the fragments have also been exposed to fire, indicating that they might be the remains of vessels, moulds or tuyères.

12.3 The provenance of the soapstone

There are no known soapstone quarries in Vestfold. Identifying the stone quarries from which the soapstone came may therefore provide information on probable trade routes and contact zones, and so shed light on Kaupang's relations with other regions.

In recent years, scientific provenancing techniques have proved promising with soapstone; they can be applied to the characterisation of soapstone with a view to "fingerprinting" the material and thereby determining its potential source (see Jones et al. 2007 for an explanation of the scientific methodology). Rare earth element (REE) analysis by *Inductively-coupled plasma-mass spectrometry*, ICP-MS, has been applied to soapstone objects from Kaupang by Dr Richard Jones and colleagues at the Scottish Universities Environmental Research Centre in Glasgow (see Jones et al. 2006 for a full presentation and interpretation of the data).

The material selected for ICP-MS analysis, 24 objects altogether (Tab. 12.14), came from stratified 9th-century deposits, the majority assigned to SP II (50%, N=12) and SP III (29%, N=7) on plots 1A, 2A, 3A and 3B. 21% (N=5) have no a specific Site Period. Different artefact-types – vessel sherds, moulds, fragment of a tuyère and a netsinker, one spindle-whorl and two unclassified fragments – have been analysed. Having obtained the rare earth element compositions, Jones and colleagues proceeded to classify the data. Recognising that there is as yet no "standard" procedure for treating and visualising these data for provenancing purposes, they experimented with three different methods: REE patterns and bi- and multi-variate data analysis (Jones et al. 2006).

In terms of composition, the soapstone artefacts were found to group into four distinct groups. Each group may represent a different production site. Although the methods do not always give exactly the same results, there is reasonable consistency (Tab. 12.11). It is very interesting to note that nearly all the vessel sherds seem to have the same origin, meaning that they were most likely manufactured at one quarry site (Jones 2006:16). Most of the other artefact-types produce a different picture. These were probably not produced in the same quarry as the vessels. In fact, several different quarries can be postulated as the production sites of this material (Tab. 12.11).

In Group 1, around half of the objects belong to SP II, while 35–39% are of SP III (Tab. 12.12), meaning that the same production site supplied vessels to this market throughout the 9th century. There was evidently significant continuity in the production and distribution of these artefacts.

More than 200 soapstone deposits have been documented in Norway to date, about half of them believed to have been vessel quarries (Geological Survey of Norway mineral resource database, www.prospecting.no), leaving several possibilities for Kaupang (Fig. 12.20). There is, however, evidence to identify certain areas as of special interest. Six of the

Group	REE pattern	Bi-variate	Multi-variate
Group 1	C52519/25919: Vessel sherd C52519/25758: Vessel sherd C52519/24134: Vessel sherd C52519/18629: Vessel sherd C52519/25379: 2 vessel sherds C52519/21662: Vessel sherd C52519/27720: Vessel sherd C52519/19784: Vessel sherd C52519/18752: 3 vessel sherds C52519/21083: Vessel sherd C52516/1826: Vessel sherd C52516/2474: Vessel sherd C52519/23876: Vessel sherd C52519/19090: Vessel sherd	C52519/25919: Vessel sherd C52519/25758: Vessel sherd C52519/24134: Vessel sherd C52519/18629: Vessel sherd C52519/25379: 2 vessel sherds C52519/21662: Vessel sherd C52519/27720: Vessel sherd C52519/19784: Vessel sherd C52519/18752: 3 vessel sherds C52519/21083: Vessel sherd C52516/1826: Vessel sherd C52516/2474: Vessel sherd C52519/23876: Vessel sherd C52516/3798: Linesinker C52519/17216: Spindle-whorl	C52519/25919: Vessel sherd C52519/25758: Vessel sherd C52519/24134: Vessel sherd C52519/18629: Vessel sherd C52519/25379: 2 vessel sherds C52519/21662: Vessel sherd C52519/27720: Vessel sherd C52519/19784: Vessel sherd C52519/18752: 3 vessel sherds C52519/21083: Vessel sherd C52516/1826: Vessel sherd C52516/2474: Vessel sherd C52519/17216: Spindle-whorl C52516/3798: Linesinker
Borderline Group 1	C52519/965: Mould	C52519/965: Mould	C52519/23876: Vessel sherd C52519/16417: Unclassified fragment C52519/22315: Unclassified fragment
Group 2	C52519/16417: Unclassified fragment C52519/22315: Unclassified fragment	C52519/16417: Unclassified fragment C52519/22315: Unclassified fragment	
Group 3	C52519/18852: Tuyère C52519/12633: Mould C52519/17216: Spindle-whorl	C52519/18852: Tuyère C52519/12633: Mould	C52519/18852: Tuyère C52519/12633: Mould
Group 4	C52516/3798: Linesinker	C52519/19090: Vessel sherd	C52519/19090: Vessel sherd

Table 12.11 *Results from ICP-MS analysis of 24 soapstone objects.*

thirteen rim sherds recovered from the settlement area are decorated. Amongst the grave goods there is relevant information on 33 find-units, of which 12 (36%) are decorated. Decorated vessels seem to have been more common in eastern Norway and south-western Sweden (Resi 1979:Abb. 127). Vessels with faceted surfaces have also been recovered, a feature which occurs almost exclusively in southern Norway (Resi 1979:Abb. 128). These make it most reasonable to look for production areas in this part of the country. The relative proximity of the quarries in south-eastern Norway and south-western Sweden also makes this region the most probable production area for Kaupang. The six counties Hedmark, Oppland, Østfold, Akershus, Telemark and Aust-Agder seem to be the most promising loca-

Group	REE pattern	Bi-variate	Multi-variate
Group 1	53% (9) = SP II 35% (6) = SP III 12% (2) no SP	44% (8) = SP II 39% (7) = SP III 17% (3) no SP	41% (8) = SP II 35% (6) = SP III 24% (2) no SP
Borderline Group 1	100% (1) no SP	100% (1) no SP	67% (2) = SP II 33% (1) = SP III
Group 2	100%(2) = SP II	100% (2) = SP II	-
Group 3	33% (1) = SP II 33% (1) = SP III 33% (1) no SP	50% (1) = SP II 50% (1) no SP	50% (1) = SP II 50% (1) no SP
Group 4	100% (1) no SP	100% (1) = SP II	100% (1) = SP II

Table 12.12 *Distribution within SP I–III.*

Quarry	Farm	Farm no.	Municipality	County	Artefact-type, Inventory no.
Folvelsetra	Folvel	176	Nes	Akershus	-
Piggåsen	Guttarsrud	27	Fet	Akershus	Vessel sherd C52519/19090
Solerudbruddet	Solerud	123	Marker	Østfold	Tuyère C52519/18852
Fluetjern	Storskogen, Krok	2	Marker	Østfold	Fragment C52519/16417

Table 12.13 *The possible origin of three soapstone artefacts.*

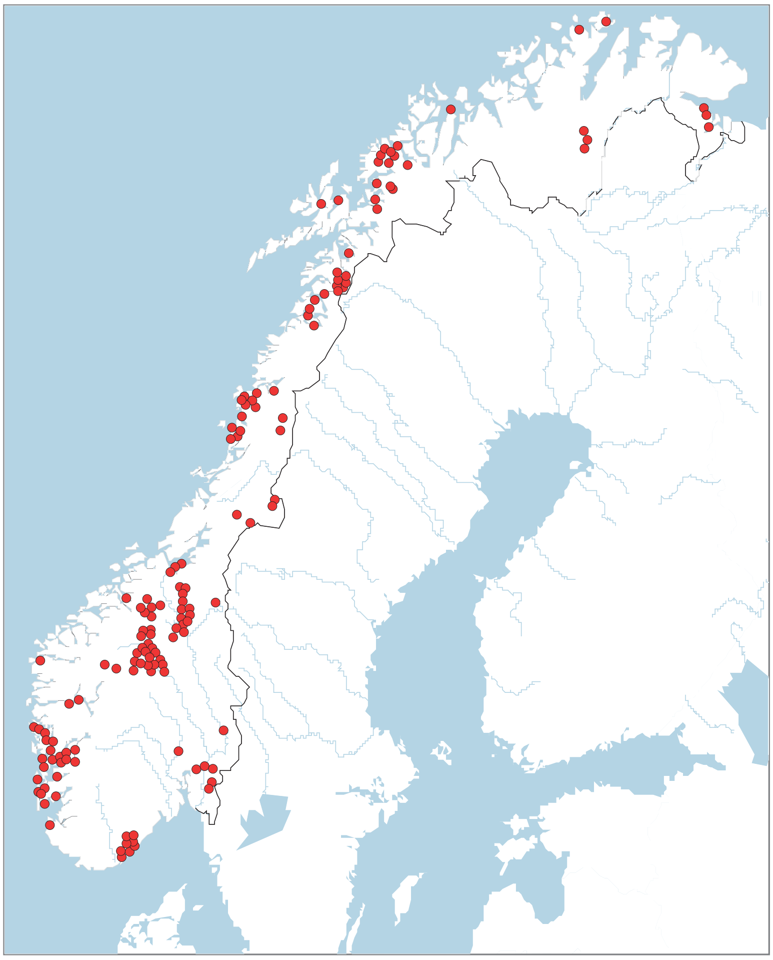


Figure 12.20 *Map of the location of known, undated soapstone quarries. Copyright, Geological Survey of Norway mineral resource database, www.prospecting.no*

tions. Soapstone quarries are few in Buskerud, and probably of later date (Skjølsvold 1961:138–9).

In the area around Kaupang, there is a concentration of soapstone finds along the coast and along waterways, particularly Numedalslågen (Resi 1987:98). Quarries in the Telemark area could be the sources. Earthslips and more recent production have, however, destroyed most of the evidence of the largest quarry in this area, which was situated near Rjukan (Skjølsvold 1961:55). This makes it difficult to take samples for ICP-MS analyses. The other quarries in Telemark are thought to be later (Skjølsvold 1961:118).

For these reasons it was decided to take samples from production areas in regions north and east of Kaupang. Quarries in four areas in Akershus and Østfold were chosen. These four are all thought to be early, most likely of the Viking Period (Skjølsvold 1961:46–51 and 136), and they have not been damaged by more recent activities. Characteristic of all of these production areas is that they contain several quarries with a large amount of production waste, indicating extensive production, probably for a large market. This was a particularly important factor in the selection process. Ideally, more quarries and additional districts should have been included in the survey, but this was not possible within the boundaries of this project. Five samples were taken from heaps of production waste connected to each of the four quarries listed in Table 12.13.

A comparison of the results of ICP-MS analysis of both the artefacts and the quarries indicates that most of the soapstone artefacts cannot be matched definitely to any of these quarries. Disappointing though this may appear, it should be borne in mind that this research represents a useful start but is scarcely complete. Further sampling should be undertaken at the quarries to establish whether the range of composition within each quarry could be wider than appears to be the case at present; in addition to sampling and analysis at other quarries in south-eastern Norway and beyond. Until the chemical database for the quarries has been expanded in this way, further discussion is premature. However, there are a small number of artefacts for which an association with one or the other of these quarries does seem promising (see Tab. 12.13; Jones 2006:16). All three objects are allocated to SP II.

The study has raised several methodological points on the sourcing of individual artefacts, and what confidence can be held in the result. In any event, the present results will have to be scrutinized, first in the light of an expanded chemical database of Norwegian soapstone and, secondly, complementary data sets, ideally both mineralogical and isotopic. As a first step the artefacts themselves should be viewed in the light of the present results (Jones et al. 2006:16).

12.4 The dating of the artefacts – conclusions

The soapstone assemblage from the settlement and the surrounding burials shows that soapstone artefacts were used in Kaupang from c. AD 805/810 onwards, while the oldest datable finds from the graves date to the period 900–1000 (Stylegar 2007:80–1).

As soapstone is not very susceptible to post-depositional processes and the excavation and sieving methods used at Kaupang were very thorough, the 806 finds in total, 131 of them from stratified deposits, are likely to be reasonably representative of the actual assemblage deposited. Because of this, comparison between Site Periods is probably relatively unproblematic. Only 72 objects of soapstone (when unidentified fragments are excluded) have been found in stratified contexts assigned to SP I–III, which are dated to AD 800–900 (Tab. 12.1). However, as most of the objects in the ploughsoil date from the 9th or early 10th century (Pilø 2007c:177–8; Pedersen and Pilø 2007:186–9), the vast majority of the soapstone finds should be from the Viking Period.

Except for one single spindle-whorl, there are no finds of soapstone from Site Period I, and, as noted above, this whorl may actually belong to SP II. Soapstone does not seem to occur before the establishment of a permanent settlement at Kaupang in SP II, from c. AD 805/810.

SP I seems to have been quite short and represents seasonal settlement on the different plots. However, the absence of a permanent settlement is probably not the explanation of the lack of soapstone artefacts from this period. Finds on the site indicate some sort of craft and production even in this initial settlement phase. Evidence of the manufacture of glass beads has been recorded (Gaut, this vol. Ch. 9:202, 232–47), and finds of slag and crucibles testify to metalcasting in this period (Pedersen, in prep.). However, there are remains of neither tuyères nor soapstone moulds. About 240 pottery sherds have been recovered, most of which should be seen in connexion with domestic activities and the preparation of food (Pilø, this vol. Ch. 10:301–2). This is a striking contrast to the absence of sherds from soapstone vessels. Even though the latter may have had a long use-life, the complete absence of soapstone sherds in SP I should be seen as evidence that soapstone vessels were not in use in this initial settlement phase.

One explanation of the absence of soapstone in SP I could be chronological, i.e. that there was no production or exchange of soapstone artefacts on a major scale at this time. Soapstone vessels are absent from the graves of the centuries prior to the Viking Period, reflecting a hiatus in the production of soapstone vessels in the Late Roman Iron Age and Migration Period (Pilø 1990:89). The settlement at Kaupang was established around AD 800, perhaps a few years before the large-scale production and distribution of soapstone artefacts started. A study of Viking-period burials in Norway lends support to this hypothesis by showing a much greater frequency of soapstone vessels towards the end of the period than at the beginning (Risbøl 1994:133). This is also reflected through the burials in Vestfold, where there are many more vessels from the 10th century than from the 9th (Stylegar 2007:80).

Finds from southern Scandinavia give the same impression. The distribution of soapstone artefacts to this area started shortly after AD 800. There are, for instance, no soapstone finds from the market site of Groß Strömkendorf, which was abandoned c. AD 810, while at Ribe the oldest soapstone finds are from the period AD 800–820. Only 40 vessel sherds have been recorded at Ribe, probably because the main activity in the market place there pre-dates the large-scale production and distribution of soapstone in the Viking Period (Feveile and Jensen 2000:fig. 11; Sindbæk 2005:137–8 and 140). The same explanation has been given for the virtual absence of soapstone at Dorestad (Kars and Wevers 1982:176). At Birka, too, soapstone vessels are absent in the earliest period (Ambrosiani et al. 1973:234). This may show that the large-scale production and exchange of soapstone vessels began some time after SP I at Kaupang, and the evidence points towards a growth in the production and consumption of vessels in the course of the Viking Period. Even though soapstone vessels in Norway were replaced by ceramics sometime around the birth of Christ, soapstone was still used, however, as a material for making spindle-whorls and loomweights (Pilø 1990:93). Nevertheless, these soapstone artefact-types are also absent from Kaupang in the first period of settlement.

It should be borne in mind that the use of soapstone was a cultural trait. The absence of this material in SP I might be explained by the early inhabitants of Kaupang having come from areas with no tradition in using soapstone; likewise the fact that other raw materials were largely preferred over soapstone in SP II and III.

While Viking-period settlements in Norway generally show a preference for soapstone over pottery, to the near exclusion of the latter (Petersen 1951:380–4), the opposite seems to be the case at Kaupang, even in the later Site Periods. A total of 448 vessel sherds of soapstone were recovered from the settlement, but pottery is represented by more than 5,000 sherds. Although not all of the pottery is from cooking pots (Pilø, this vol. Ch. 10:Tab.10.1 and 301), the relative quantities seem to reflect significant differences in usage. This pattern recurs with spindle-whorls and loomweights: Kaupang has a greater density of fired clay than stone compared with other parts of the country (Øye, this vol. Ch. 13:358–9). However, a problem here is that products of soapstone would probably survive much longer than pottery or artefacts of fired clay. Therefore, compared with ceramic cooking pots, soapstone vessels must have been much more frequently used than the relative numbers of soapstone and pottery sherds seem to suggest.

Another problem is the difficulty of estimating the quantity of soapstone vessels recovered. Repairs and re-use of broken vessels seem to be common. As already noted, 83 of the sherds have perforations, the majority of which should be considered to be traces of repair. Each vessel may therefore have had a long life of use, meaning that fewer vessels were needed than if pottery had been used. The reworking and re-use of vessel sherds also seem to be quite common. Many vessels and vessel sherds will consequently never have reached the archaeological deposits, as reflected by the paucity of finds of base or rim sherds. It is therefore difficult to estimate the quantity of soapstone vessels, and the assemblage does not seem to reflect the actual quantity of vessels used at Kaupang. Nevertheless it does show a difference in the material used for cooking pots compared with other Norwegian Viking-period settlements, where pottery is consistently lacking.

12.4.1 The production of soapstone artefacts at Kaupang

34% (N=280) of the soapstone assemblage is made up of miscellaneous and unclassified fragments, some of which may be waste from the shaping and cutting of soapstone objects, while some may be from broken objects. More than 90% of the fragments measure less than 5 cm, and no large pieces of soapstone were found during the excavations of 1998–2003.

At Hedeby only 1% (48 fragments) of the soapstone material is made up of unclassified fragments of possible production waste (Resi 1979:99–101). The difference is remarkable. A contrast in excavation techniques may explain the figures, the main difference being the rigorous sieving regime in the Kaupang excavations of 2000–2003. Only 10% of the material from the previous excavations at Kaupang consisted of unclassified fragments (Resi 1979:101), showing how different excavation methods can produce different results.

One of the characteristics of vessels of the late Iron Age is their uniformity of both shape and manufacture, indicating mass production with a view to exchange (Skjølsvold 1961:99–100). Although there is variance in size, thickness and form, the material from Kaupang, both from the settlement and from the graves, also indicates a certain uniformity in vessel-type, quality and manufacture, which may reflect mass production. The vessels were probably brought here as more or less finished products. This is supported by finds of almost finished vessels from rubbish heaps near many of the quarries, which show that the vessels were more or less finished there before they were transported to the consumers (Skjølsvold 1961:86–7; Resi 1987:99).

There are, however, indications that the final finishing of the vessels, the polishing, was carried out, in some cases at least, outside the quarries. Five vessels of different sizes have been found in a bog at Hafstad, Aust-Agder, about 3 km from the nearest quarry. They are interpreted as trade goods. They were probably produced as a set, with some uniformity of shape, although they differ in size (Fig. 12.21). Two of the vessels have marks on the rims that were probably made by the stonecutters, and which may reflect professional production for sale (Skjølsvold 1961:21, 89–90 and 100–1). As already noted, a few sherds with rough and unpolished surfaces have been found both at Kaupang and Hedeby (Resi 1979:44), indicating that the polishing of vessels may have taken place at the market places. The same phenomenon has been observed at the later medieval market site of Borgund in Sunmøre. A possible explanation of the transportation of unpolished vessels is the risk of breakage *en route*. A thicker vessel is more solid and durable (Lossius 1977:62). Finds from the assemblage at Kaupang also show that vessels with a rough and unpolished interior surface were used as cooking pots, indicating that the deliberate smoothing of the vessels was not always considered necessary.

Some large pieces of raw material (the measurements are currently unknown) were, however, found at the settlement site during the excavations of 1956–67. This has been interpreted as evidence of the importation of soapstone as raw material to Kaupang and the re-export of finished products (Blindheim 1973a:148). There are no unfinished vessels, however, and altogether the evidence does not point to any extensive production of soapstone vessels.

It is more likely that the unclassified fragments found at Kaupang are remains of both the primary production of small artefact-types, and the secondary reworking of broken objects. Some vessel sherds bear evidence of reworking after breakage, and some of the spindle-whorls, loomweights, sinkers and moulds seem to be the products of secondary production using broken cooking pots; the fragmentation and re-use of vessels does imply quite intensive use of the soapstone. The softness of soapstone made it quite easy to work, and one did not need special skills to make small and simple artefacts, therefore the inhabitants could have made these themselves. The same pattern is to be found at Hedeby and in medieval towns in Norway such as Bergen, c. AD 1150–1500, and the market site of Borgund in Sunmøre c. AD 1070–1600 (Lossius 1977; Resi 1979, 1981:4; Øye 1988:20 and 136). The re-working of broken soapstone artefacts is, in fact, found in most assemblages, and seems to be normal. Amanda Forster has shown that spindle-whorls, moulds, tuyères and weights were more often made on site from broken vessel sherds than primary products (Forster 2004:48 and 162). At Kaupang, however, some of these artefacts were probably brought in as

the finished results of primary production. The ICP-MS analysis of the more diverse soapstone finds, including unidentified fragments which may be production waste, indicates different production areas for most of these objects from the vessels, implying that they were not all made out of broken vessels in the settlement.

12.4.2 The exchange of soapstone

As there are no soapstone outcrops in Vestfold, the objects of soapstone must have been imported from other regions. Two important questions must be answered concerning the exchange of soapstone artefacts: Are the soapstone artefacts at Kaupang the result of trade, and was this soapstone a commodity for re-export?

According to the ICP-MS analyses, a single production site seems to have manufactured vessels for Kaupang in both SP II and SP III, while some of the other artefact-types were probably manufactured at a range of different production sites. It is possible that both the vessels and the other artefacts were brought in as trade goods. The fact that only one quarry site seems to have produced vessels for this market may, however, imply stricter control of the production and distribution of vessels than of many of the other artefact-types. There may therefore be reason to look for different explanations concerning the various object-types. Let us start with the non-vessel artefacts.

As already noted, not all of the artefacts recovered were primary products. Several objects, such as spindle-whorls, loomweights, sinkers and moulds, are secondary products from broken vessels, probably re-worked within the town. Objects of secondary manufacture from broken vessels are not thought to be likely objects of trade. Some non-vessel artefacts may nevertheless be primary products. A few linesinkers have been made using special skills and techniques. The fact that the non-vessel artefacts are from various quarries indicates a more independent and diverse production of these artefact-types than of the vessels. Some of these may have been brought to Kaupang as personal possessions carried by their owners, but some sort of trade could have been going on. Would the purpose of such trade have been just to supply the inhabitants at Kaupang, or were these goods meant for further trading?

A total of 78 non-vessel artefacts were identified (Tab. 12.1). About 32% of these, mostly tuyères and moulds, bear clear signs of having been used, leaving just 54 objects as possible items meant for re-export. With some of the artefact-types, however, such as spindle-whorls, loomweights and sinkers, it is not easy to see signs of use, and the number of artefacts used at Kaupang should be considered a minimum estimate. Since some of the non-vessel artefacts are secondary products and probably not for trade, the number of artefacts intended for export must be even lower. Many of the soapstone artefact-types, such as spindle-whorls, loomweights and linesinkers, are few compared with equivalent artefact-types of other materials such as fired clay and other types of stone. Most of the evidence thus points towards

Figure 12.21 *A set of five unpolished vessels – trade goods? – recovered from a bog in Aust-Agder. Photo, KHM.*

most, if not all, of the non-vessel artefacts as being meant for use at Kaupang. Whether they were brought there by their owners or as objects of trade remains an open question.

The vessels, on the other hand, present a somewhat different picture. The soapstone artefacts of the Viking Period, especially the vessels, reveal more intensive manufacture and distribution in this period than before (Skjølsvold 1961:12–13). A comparison of the distribution of graves containing soapstone vessels with the location of soapstone quarries shows little correlation between sources and clusters of deposition, and trade has been seen as a possible explanation of this (Resi 1987:95–8).

The degree of variation in the shape of various elements of the soapstone vessels is an important indicator of the character of production: mass production of vessels of standardized shape or the more individual production – for instance at farmsteads – making more irregular vessels to satisfy specific needs. In spite of the fragmented state of the Kaupang material, the vessels and vessel sherds from both the settlement area and the surrounding graves reveal a certain uniformity of vessel-types that suggests serial production. Serial production presupposes a considerable number of customers and is usually aimed at a market (Skre 2007j:450). The vessel assemblage from Kaupang may therefore derive from trade, and, as stated above, only one production site seems to have made vessels for this market. This indicates continuity in production and distribution of the vessels throughout the 9th century.

Do the vessels recovered represent goods that were intended for re-export, or were they simply brought in because of a local need in the town? What was Kaupang's role in the distribution of these items?

There is evidence of domestic use in the vessel assemblage. As only 448 vessel sherds were recovered during the fieldwork from 1998 to 2003, and 22%, which should be considered a minimum estimate, show signs of use, there is no clear evidence in the assemblage that soapstone vessels constituted an important export article. Besides, a considerable number of the vessel sherds datable by Site Period were recovered from midden deposits (Tab. 12.3).

There was obviously a need for various sorts of soapstone object at Kaupang, both for household use and in certain craft activities: a need which seems to explain the occurrence of much of the material recovered. There is also evidence that other Viking-period towns, such as Hedeby and Ribe, should be seen as receivers rather than centres of redistribution for soapstone products. The distribution map of soapstone in Denmark and northern Germany shows that the area around the Limfjord and the coast of the Kattegat were the main areas receiving soapstone in southern Scandinavia, while the areas surrounding Hedeby and Ribe have far fewer finds. It is possible that the distribution of soapstone artefacts around the Kattegat may be explained by exchange between farmers and fishermen and not as the result of organized trade, even though the latter cannot be excluded (Sindbæk 2005:141–2 and 160). The quantity of soapstone artefacts in Denmark does not, however, indicate any need for large-scale importation of these objects. Some were obtained, but they were not essential, as there were local alternatives (Ulriksen 2004:24). In later medieval Bergen, as well as at the market site of Borgund, the soapstone vessels found are explained by local needs, and not as reflexes of transhipment (Lossius 1977:60; Vangstad 2003:76–8).

We cannot, however, exclude the possibility that vessels were indeed redistributed from Kaupang. The material found in the settlement area reflects domestic use, but soapstone vessels meant for further trading may have been in another location, not detected by the excavations. However, despite several surface surveys conducted in the settlement area, it has not been possible to locate any concentration of vessel sherds that could indicate the storage of unused vessels. There are no indications in the settlement finds of the exportation of vessels from the site.

Even though vessels seem to be few in number compared with the pottery in the settlement area, a large number of vessels have been recovered from the graves. Vestfold is one of the regions in Norway with the highest frequency of soapstone vessels from graves. Many of the vessels are from the municipalities of Larvik and Hedrum (Skjølsvold 1961:117), and it is especially interesting to note a predominance of graves containing soapstone vessels in the burials around Kaupang, a detail that has been connected to a trade in soapstone (Risbøl 1994:136–8). These items could have been brought here as personal possessions or distributed by travelling people. However, in view of the general frequency of vessels in Vestfold, and the fact that Kaupang was an important market site, it is more likely that the large quantity recovered is in some way connected with the trading of soapstone.

It is, of course, difficult to identify forms of transaction for the vessels from the archaeological evidence alone. It may have been exchange between local farmers, while the possibility that vessels were exported directly from production sites to consumers, both in Norway and in southern Scandinavia, should perhaps also be considered. However, a large-scale production and distribution of vessels presupposes contact networks and access to a large number of customers, which would more easily be obtained at a market or a town. Previous research has, therefore, explained the distribution of soapstone vessels as a product of organised long-distance trade (Risbøl 1984:142; Christophersen 1989:120–2). Axel Christophersen (1989) has outlined a model in which the elite played an important part in the production and distribution of soapstone vessels and other goods. The products, in his view, became objects in an exchange system through which they were converted into foreign luxury items – an activity that took place at market sites. This model presupposes a hierarchical social structure with an elite in control of the resources and others involved in the production and distribution of goods.

There are indications that male burials of the Viking Period containing soapstone vessels should be seen in connexion with the distribution and exchange of such vessels. The vessels are found in relatively rich male graves. These are concentrated in areas that seem to have been involved in trade, and many of them also contain weights and balances (Risbøl 1994:136–40). The vessels are not thought to be luxury items, but rather were used by most people. As a consequence, the status associated with the vessels in the rich graves must be explained as something more than mere ownership of the vessels. It is possible, therefore, that the vessels in rich graves can be linked to the production and exchange of such goods (Risbøl 1984:134). This may support the theory that those who organised and administered the production and exchange of the vessels were of high status. Rich male graves containing soapstone vessels may therefore indicate an organized trade in vessels rather than exchange between farmers. Several agents may have been involved in the distribution of vessels to Kaupang, but the possibility that Kaupang acted as a local distribution centre for soapstone vessels should also be allowed. It would explain the large number of graves containing soapstone vessels in Vestfold.

At Kaupang there are 37 graves with soapstone vessels, and four of these graves also had items that can be associated with trade such as weights, balances, and in one case possibly hacksilver. Soapstone vessels are found in both male and female graves, and a great majority of the burials are quite rich. 26 of the graves contained weapons, constituting about 70% of graves with soapstone vessels, while the percentage of weapon graves in the total material is about half (79 graves, 38%, N=204). Seven of the weapon graves with soapstone vessels also had the full weapon-set of sword, spear and axe (Stylegar 2007:83 and 104–27). From the arguments above, it is tempting to suggest that the vessels in many of the graves should be associated with a trade in soapstone in which Kaupang played a part. Whether the vessels were brought here directly from the production site or, as has been suggested, from regional market places closer to the quarry sites (Schou 2007), remains an open question.

Kaupang had significant links with long-distance trade systems in the Viking Period (Skre 2007j:453). But were the soapstone vessels also involved in long-distance trade, as earlier scholarship seems to assume (e.g. Skjølsvold 1961:117 and 130; Christophersen 1991:166)? Previous research does suggest that soapstone artefacts were commonly exported from Norway in the Viking Period to markets and other areas with no local supply (Skjølsvold 1961:129–35; Resi 1979, 1985:95; Forster 2004). Soapstone artefacts are usually found in all areas where permanent Scandinavian settlements were located in the Viking Period (Sindbæk 2005:137), and were probably objects for everyday use rather than luxury items (Roesdahl 1980:99; Risbøl 1994:134). Charlotte Blindheim explained the occurrence of soapstone at Hedeby as a result of exchange with Kaupang, and Ohthere's account from the late 9th century testifies to contact between these two sites (Blindheim 1973b:154). The soapstone assemblage at Hedeby may be of Norwegian origin. Geological surveys of the material indicate that quarries in Halden in Norway and Halland and Bohuslän in Sweden may be the production sites for Hedeby (Alfsen and Christie 1979:182). The material is also very similar to the assemblage at Kaupang: the same artefact-types, including many of the same vessel-types, occur on both sites.

As already noted, soapstone artefacts appear in southern Scandinavia from shortly after AD 800 (Sindbæk 2005:137), which corresponds closely with the establishment of Kaupang. There also seems to be a predominance of soapstone in northern Jutland (Risbøl 1994:127; Sindbæk 2005:161), an area with close contacts with Kaupang which is also reflected in finds of pottery (Hougen 1969b:98; Pilø, this vol. Ch. 10:296–300). On the other hand, the pottery at Kaupang also reveals close contacts with the Rhineland and market sites such as Dorestad (Hougen 1969b:98; Pilø, this vol. Ch. 10:286–92 and 295), where only a few soapstone artefacts are found (Kars and Wevers 1983:169). In Ribe, Birka and York, soapstone is represented by very few finds (Ambrosiani et al. 1973:234; Mainman and Rogers 2000:2478 and 2541–4; Sindbæk 2005:149). However, as noted above, this may have a chronological explanation. Although it is argued that the soapstone recovered in York may be from Shetland (Mainman and Rogers 2000:2544), a recent study indicates a Norwegian source (Forster 2004:293–5). Soapstone vessels were also imported to Viking-period Dublin (Wallace 1985:135), but the total assemblage of artefacts recovered is currently unknown. A Norwegian provenance is also proposed for these finds (Forster 2004:295). Soapstone was thus widely distributed, but Kaupang and Hedeby are the only Viking-period towns with large amounts of soapstone artefacts.

One should also note the possibility that not all of this material is the result of trade. This seems to be the case with the soapstone goods found in the North Atlantic region. The scarcity of artefacts suggests that the objects of soapstone represent personal possessions rather than being objects of trade (Forster 2004:351 and 360). At Hedeby, on the other hand, the occurrence of soapstone items is most probably to be linked to organized distribution from Norway or Sweden. Altogether, various explanations of the distribution of soapstone artefacts in the Viking Period should be considered.

On our current evidence, it is difficult to evaluate Kaupang's role in the trading of soapstone goods. Most of the soapstone artefacts from the settlement area had been brought there to meet a local need within the town, and it has not been possible to find evidence of the re-export of such goods in the assemblage. At the same time, there are indications that the graves in Vestfold containing soapstone vessels, including the burials around Kaupang, can be seen in connexion with a trade in soapstone. Some exchange, especially with a relatively local network, may have taken place from the site. The present evidence would suggest, though, that Kaupang played a modest role in the long-distance distribution of soapstone artefacts.

Textile-production Equipment 13

INGVILD ØYE

Remains of textile-production equipment are quantitatively and qualitatively an interesting group of finds at Kaupang, represented by a total of 1,054 find-units, comprising a highly fragmentary collection of several thousand fragments. It is nevertheless possible to identify particular categories of equipment for textile production, mainly for spinning and weaving. Together with a small number of other implements – weaving battens, needles, shears and smoothing stones – these reflect varied textile production.

The loomweights constitute the largest group of finds, totalling more than 800 find-units or over 3,600 fragments (minimum weight c. 67 kg). The actual number of loomweights, and how many looms they once belonged to are difficult to estimate, however, because of their incomplete character.

The 180 or so spindle-whorls that have been found belong to different categories of shape, size, weight and material, indicating varying production of yarn of different degrees of fineness and strength, from the finest thread to coarser ones used for a range of purposes, and for the weaving of fine, medium or coarser fabrics. Altogether this was more specialized production than in the surrounding countryside.

The remains of this equipment show that textile production played an important role throughout Kaupang's history from its initial phase until the town vanished by the mid-10th century. Seen as a female occupation, textile-production equipment and textile production also indirectly shed light on the economic, demographic and social structure of Kaupang, indicating that women played an important role in the town. The textile-production equipment is similar to that found in other Viking-period towns, such as Birka and Hedeby. However we must not draw too wide-ranging conclusions, for only a small part of Kaupang's settlement area has been excavated and a small sample of textile-production equipment has been found.

Textiles have been, and still are, both indispensable necessities and attributes of affluence that can signify status and rank. The production of textiles, therefore, has long been an important industry both within the domestic sphere and as a specialized craft. The work involved was complex and required a range of competencies in many time-consuming processes, from preparing raw material such as wool, flax or hemp to spinning, weaving and sewing a wide range of products in different qualities – cloth, all kinds of clothes and garments, household linen, tapestries, carpets, sails, and more. Textile production also has gender implications as it seems to have been mainly a female occupation before the professionalization of urban crafts in the High Middle Ages.

In archaeological research, equipment for textile production has been afforded far less attention than finds of textiles and textile remains. This is also the situation at Kaupang, where finds of textiles from the burials have been analysed (Ingstad 1999), at least partly, but not the equipment. The implements can, however, shed light on the actual production at the sites more directly, while differences in the quantity and range of the equipment may signify different kinds of production and manufacture. Although the tools were rather simple – a couple of wool or linen combs, a few spindle-whorls of different sizes, needles of different thicknesses, a loom and sets of loomweights for a loom were all that were needed to produce the textiles needed by a household or other consumers – fine differences amongst spindle-whorls and loomweights, and the variety of implements can be significant and reflect different types of quality and fabric. They are therefore also indicative of the degree of specialization and standardization. Such differences in the 'tool kits' have also been detected at different types of settlement – in rural, proto-urban and urban contexts respectively (Andersson 2000, 2003; Øye 1988, 2010) – concurrently shedding light on the character of the settlement and the presence of women. Indirectly, they may also reflect women's roles, either as producers for the household's own needs or on a more specialized basis on a larger scale for wider groups of consumers. They thus yield information on the urban structure as such: its demographic, economic and social constitution.

The aim of this chapter is to analyse the textile-production equipment found at Kaupang, both in the settlement area and in burials in the surrounding cemeteries, in order to illuminate the character of textile production and ultimately the agents behind it. I shall also look at the textile-production equipment in a wider context and compare it with the evidence from Hedeby and Birka, and in rural areas.

The questions to be considered relate to the degree of standardization of the implements, their chronology and context: What equipment has been found? Can one or more groups be discerned amongst the implements? Is the range of equipment the same throughout the whole period of Kaupang? In what contexts are the implements found, and where do they occur most frequently? Do they show differences or similarities to those from other, contemporary, urban and rural settlements?

The study is based on the identification of textile-production equipment from the different surveys and excavations at Kaupang, focussing on the excavations and surveys of 1998–2003, comprising the Cultural Management Trench (CRM) in 2000 and further a series of trenches excavated in 2000–3 and the main research excavation area of 2000–2 (MRE), covering an area of 1,100 sq m, of which 400 sq m were excavated down to the original beach deposit: a total of 3,100 sq m (Pilø 2007b:153–4). The field surveys, using traditional fieldwalking and metal-detection as survey methods, covered an area of 62,500 sq m, of which 46,500 were metal-detected (Pilø 2007b:147). Equipment for textile production has been found in all these areas, with loomweights and fragments of loomweights dominating the material, with 470 entries from MRE out of a total of at least 611 find-units, weighing c. 47 kg altogether; 121 possible spindle-whorls, a weaving batten, two pairs of shears and a limited number of other items: needles, needle-cases and smoothing stones. Finds from Charlotte Blindheim's excavations of 1956–1974 in the northern part of the settlement area, an area of 1,475 sq m of which c. 50 sq m were fully excavated (Tollnes 1998:15), are also considered. The textile-production equipment from these excavations is also dominated by loomweights: altogether 221 find-units, weighing about 20 kg. The study also includes material from the burial mounds excavated by Nicolaysen at the cemeteries of Nordre and Søndre Kaupang (cf. Blindheim et al. 1981) and Blindheim's investigations in the cemeteries at Bikjholberget and Lamøya of 1950–7 (cf. Blindheim et al. 1995, 1999). Here, textile-production equipment and possible textile-production equipment has been recorded in 37 of the 116 graves that contain closely datable finds out of the total of 204 graves. The Kaupang graves have been reinterpreted and catalogued by Frans-Arne Stylegar (2007:103–28) and his catalogue is used in the following (Ka.). I have been through all of the material from the 1998–2003 fieldwork, checking and supplementing the catalogue entries, and through the textile-production equipment from Blindheim's settlement excavations and the graves as far as they can be retrieved and are available for analysis.

The conditions of preservation and field documentation influence the representation of finds, including the textile-production equipment. Modern agriculture has largely disturbed the evidence in the ploughsoil and mechanical breakage has resulted in rapid deterioration (Pilø 2007b:146) and highly fragmented finds. While the ploughsoil was examined in the 1998–2003 excavations and surveys, it was removed both mechanically and manually in Blindheim's excavations without sieving (Tollnes 1998:17). The recovery of equipment for textile production from the two excavation campaigns differs as a result, and the results cannot directly be compared. Generally, the find conditions at Kaupang have been unfavourable both to organic material and to metals (Pedersen and Pilø 2007:182). This is also the case in respect of Blindheim's settlement excavations.

13.1 The textile-production processes and the find-groups

13.1.1 Spindles and spinning

Threads have been spun for different purposes: for making bands, nets, but probably most of all for weaving into clothing and various fabrics, requiring different qualities of thread. The quality of the spun yarn is dependent upon at least three factors: the quality of the fibre, the skill of the worker, and the equipment. It has been claimed that the implements used in spinning are so simple that their own quality is unlikely to be reflected in what they produce (Wild 1970:31). This view has, however, been contested by experimental archaeology. Results from spinning tests indicate that it would have been the implements rather than the spinners that influenced the quality of the threads (Mårtensson et al. 2006a:17) – a conclusion that argues for the importance of detailed descriptions of the spinning equipment to illuminate the character of the textile production.

The most frequently found piece of spinning equipment from the Viking Period is remains of the spindle, in this case spindle-whorls. A spindle consists of a whorl attached to a spindle-rod and a distaff (Fig. 13.1). As the whorl is usually made of more durable material than the wooden rod, it is this that is most frequently found, and only the spindle-whorls are represented in the Kaupang material. After the preparation of the textile fibres, they are twisted into a short thread that is attached to the rod so that it can hang freely and be rotated at the same time as the person spinning can draw out the fibres from the distaff. Being twisted around its own axis makes the thread. The thread has to be wound up when the spindle reaches the ground. A tighter thread needs extra spin to increase the density of twists per centimetre. The spindle can also be supported on some base, such as the floor or a bowl, when spinning fine and weak threads (Warburg 1974:78). The direction of spinning may be to the left, so-called S-spinning, or to the right, Z-spinning (cf. 13.5.3). When two threads are plied they may be spun in the same direction or in opposite directions, the latter giving a stronger twist and a yarn of greater strength (Warburg 1974:15). In general, the yarn is dependent upon the material used, the way of spinning, the twist and the amount of plied yarn (Warburg 1974:17).

The weight and size of the spindle and the spindle-whorl affect the thickness and quality of the yarn. Experiments have shown that both the size and the weight of the whorl affect the thread, especially the weight. Even very small differences of 5 g make a clear difference in the thickness and quality of the yarn (Andersson 2003:25–6).

Experimental research in spinning with a drop-spindle and weaving on the upright loom at the Centre for Textile Research (CTR) at the University of Copenhagen has given new insight into how different spindle-whorls and loomweights function. Whorls of different weights and their effect upon the quality of the thread have been tested (Mårtensson et al. 2006a, 2006b, 2006c). By using whorls of 4, 8 and 18 g, the experiments demonstrated that differences in weight have important implications not only for the quality of the final thread but also for the preparation of fibres and the spinning – how much of the wool had to be sorted out and discarded, and the time spent in the whole process. Different spindle-whorls also govern the number of fibres the thread may contain. The lightest whorls needed another type of wool, softer and more homogeneous than heavier whorls. Consequently, it is more time-consuming to spin a thread with a light whorl than with a heavier one (Mårtensson et al. 2006b:7). Spinning is also greatly affected by whether the spindle-hole is centred or not. For the very lightest whorls the spindle-hole has to be perfectly centred, and more twist has to be given than with 8 and 18 g whorls. The experiments also showed that it requires intense concentration to spin with the lightest whorls, so that this could hardly have been done in combination with other tasks. With an 18 g whorl, however, unprepared sorted wool can be used (Mårtensson et al. 2006a:9, 11 and 14). Historically, it is known that whorls of c. 25–35 g were commonly used to spin the wool from the common Norwegian short-tailed sheep, and whorls of 50 g for plying the yarn (Lønning 1976:20).

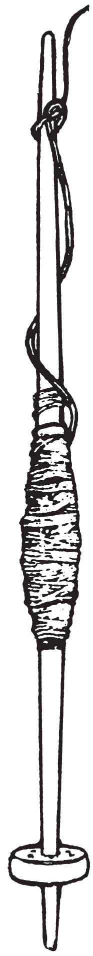


Figure 13.1 *Spinning equipment. After Øye 1988.*

The diameter of the spindle-whorl also affects how tight the spin can be. A large spindle-whorl does not spin so tight a thread as a small and relatively heavy one, and a conical spindle-whorl turns more quickly than a disc-shaped one (Warburg 1974:89), and so on. Experiments at the CTR have shown that whorls of larger diameter are more suitable for spinning plant fibres (Mårtensson 2006b). The height of the spinning-whorl helps to centre the weight to the rod. The shape of the whorls also affects their rotation and the rate of revolutions per minute (rpm). Thus a disc-shaped whorl has higher torque than a conical one of the same weight. Experiments have also shown that light spindle-whorls rotate markedly faster than heavy ones. While a 4 g spindle-whorl has a frequency of 3,600 rpm, a 15 g one has 2,500 rpm, a 23 g one 2,100 rpm, and a 40 g one 1,600 rpm (Linder 1967:56). At the same time, the spinner also helps to give the twist needed and aimed at. The weight of the rod and the yarn wound up on the rod also add to the weight. The spindle-whorl can be placed at various heights on the rod. At Kaupang only the whorls have been found, and it is therefore impossible to determine their placing on the rod.

Altogether, experiments have shown that of greatest relevance to the final product is the weight of the whorl and its relation to the diameter, which determine whether the thread can be thick or thin,

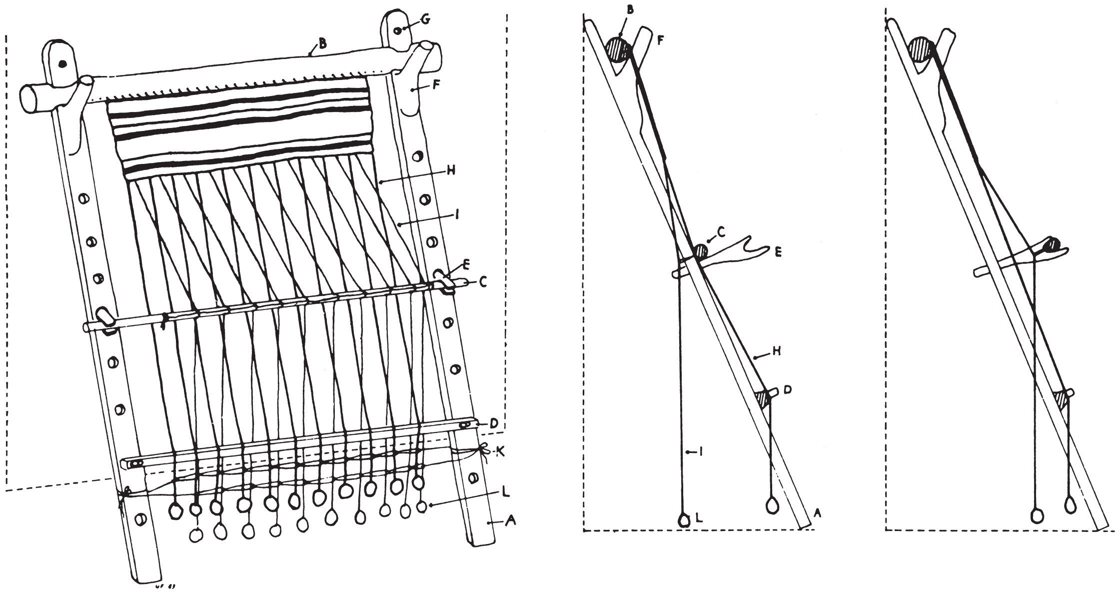


Figure 13.2 *The warp-weighted loom. After Hoffmann 1964.*

and tightly or loosely spun. I have therefore recorded the spindle-whorls' weight and maximum diameter, but also the maximum height and the position and diameter of the hole to get an indication of the size of the rod and the balance of the spindle. The material of which the whorl was made may also provide information on provenance and cultural connexions. This also has some effect upon the shape, which is both a functional and cultural trait.

13.1.2 Looms and weaving

The loom which was used in Viking-period Scandinavia and has left its traces in the archaeological record was first and foremost the warp-weighted type, an upright loom with the warp held taut by loomweights (Fig. 13.2). The weft is inserted between the warp-threads and beaten upwards with a sword-shaped beater known as a "weaving batten" made of wood, bone or iron. Iron weaving battens beat harder and therefore make the weave tighter, allowing one to weave fabrics of coarse thread more tightly and quickly than when using battens of softer material. Experiments have shown that iron weaving battens are ten times more efficient than wooden beaters when weaving tight fabrics such as sailcloth (Andersson 2003:28).

The only remains of the upright loom found in the settlement area at Kaupang are the loomweights, most often in a very fragmented condition, and a few weaving battens. Weaving battens were also found in graves, but only one fragment of a loomweight is recorded amongst the grave finds (Ka. 283) and two stray finds of remains of possible loomweights that may have come from disturbed graves (Stylegar 2007:121–7).

On the whole, lighter loomweights are suited to weaving fabrics with a thin warp while heavier weights are more useful for fabrics with a thick warp, giving the weight tension required on the threads. Experiments have shown that different tensions are needed depending on the warp-thread. Thin threads spun on the lightest whorls (4 g) required lighter loomweights than threads spun with whorls of 8 and 18 g or more (Mårtensson 2006c:11).

The majority of the loomweights from Kaupang have a discoid shape, with a central hole through which the warp-threads can be tied on. As in Denmark and southern Sweden, the majority of the loomweights at Kaupang are made of fired clay, while steatite (soapstone) was usual in other parts of Norway, except for the coastal areas of Vestfold, Vest-Agder and Rogaland and to some extent also in eastern Norway (Petersen 1951:295–300), indicating different regional preferences and cultural traditions that may go beyond purely material aspects. In recording the loomweights, therefore, size, weight, diameter or length and maximum thickness have been recorded as well as the material. The aim is to shed light both on functional and cultural aspects.

13.1.3 Sewing: needles and shears

Textile work requires different kinds of needles for sewing, sticking and binding, and pins for pinning things together. For sewing thin fabrics fine needles, often made of metal, are needed. These needles are rare amongst the finds at Kaupang, probably because of the generally unfavourable conditions for the preservation of metal or of organic material.

	State of preservation			Shape							
Material	**All**	**Com-plete**	**Percentage complete**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**?**
Steatite	34	20	59%	11	1	2	2	11	6	0	1
Sandstone	5	4	80%	2				2	1		
Other mineral	2	1	50%	1						1	
Fired clay	41	8	20%	5	5	26			1	2	2
Bone	2	0	0%	1							1
Lead	36	30	83%	12		15		3	5	1	
Other	1	0	0%	0				1			
Totals	121	63	52%	32	6	43	2	17	13	4	4

Table 13.1 *Spindle-whorls from Kaupang 1998–2003 according to material, state of preservation and shape. N=121.*

Bone needles are also rare in consequence, although they were used in many processes, for single-needle knitting, and for pattern weaving when using several weft threads simultaneously. Larger needles may also have been used as shuttles, by winding the weft around the needle and inserting it through the shed between the warp-threads.

13.1.4 Other equipment

Besides spindle-whorls, loomweights and sewing implements, there are a few finds connected with finishing, such as smoothing stones. As the conditions for the survival of metal, bone and other organic materials are generally poor at Kaupang, most of the textile-production equipment found here are more or less restricted to stone and fired clay. Implements that will very probably have been used but have not been found because of these circumstances include wool-combs, hackles, flax-beaters, distaffs, spindle-rods, reels and weaving battens of wood and bone, and tablets for tablet weaving. Nearly all items of wood and bone have vanished, leaving an incomplete view of what was actually used in the production of textiles at Kaupang. The likelihood of larger and more expensive objects of metal being lost or discarded was lower than that of losing small objects or discarding damaged or ineffective spindle-whorls or broken loomweights.

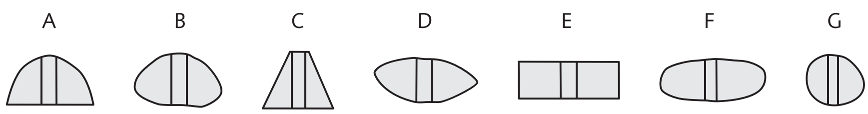
13.2 The textile-production equipment

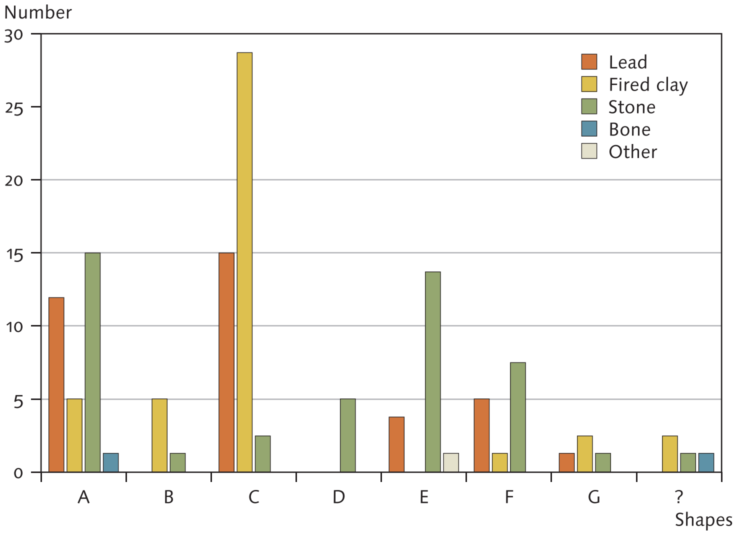
13.2.1 Spindle-whorls from the settlement area

A total of 121 spindle-whorls were recorded during the fieldwork from 1998–2003, four of which are unfinished. The record shows that of all the spindle-whorls of an identifiable material (N=120) 34% are of fired clay, 34% of stone, 30% of lead and 2% of bone. The stone whorls are mostly steatite (34 examples), while five are made of sandstone and two of some unidentified mineral. Two are made of bone. The four unfinished whorls are all made of stone: three of steatite and one of sandstone.

The spindle-whorls are quite fragmentary, with only half of the whorls complete or nearly complete. Not unexpectedly, whorls of fired clay are more often broken than those of more durable materials (lead, stone and bone). Nevertheless, 97% could be classified by shape: (A) with a hemispherical upper part and a flat base; (B) with a rounded element on the base, giving a convex curve in the cross-section: nearly biconical but rounder; (C) conical; (D) lentoid or biconical; (E) flat with straight sides; (F) flat with rounded, slightly convex sides; and lastly (G) with the shape of a flattened sphere (Fig. 13.3). Some of the whorls, however, are difficult to classify within these main types but have been classified according to their most dominant characteristics (Tab. 13.1).

Figure 13.3 *Spindle-whorls: types. Drawing, Per Bækken.*





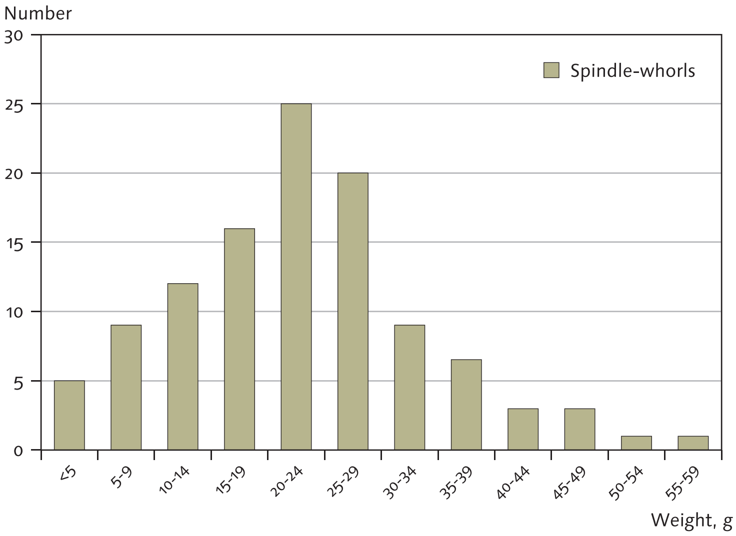


Figure 13.4 *Spindle-whorls from Kaupang 1998–2003 by shape and material. N=121.*

Figure 13.5 *Spindle-whorls from Kaupang 1998–2003: distribution by weight-groups. N=111: complete or nearly complete spindle-whorls 67, estimated weights 44.*

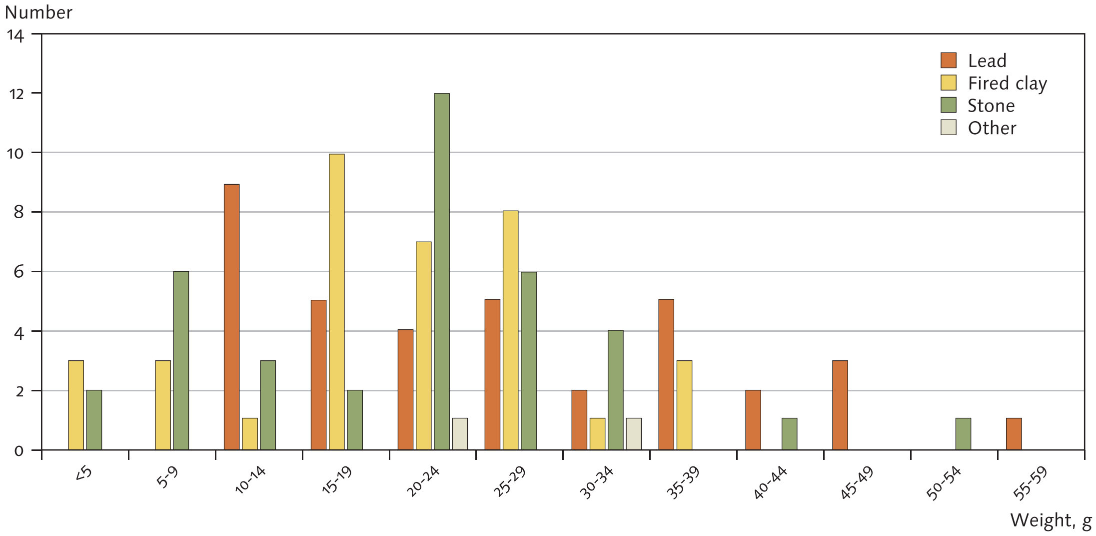
Figure 13.6 *Spindle-whorls from Kaupang 1998–2003: weight and material. N=111.*

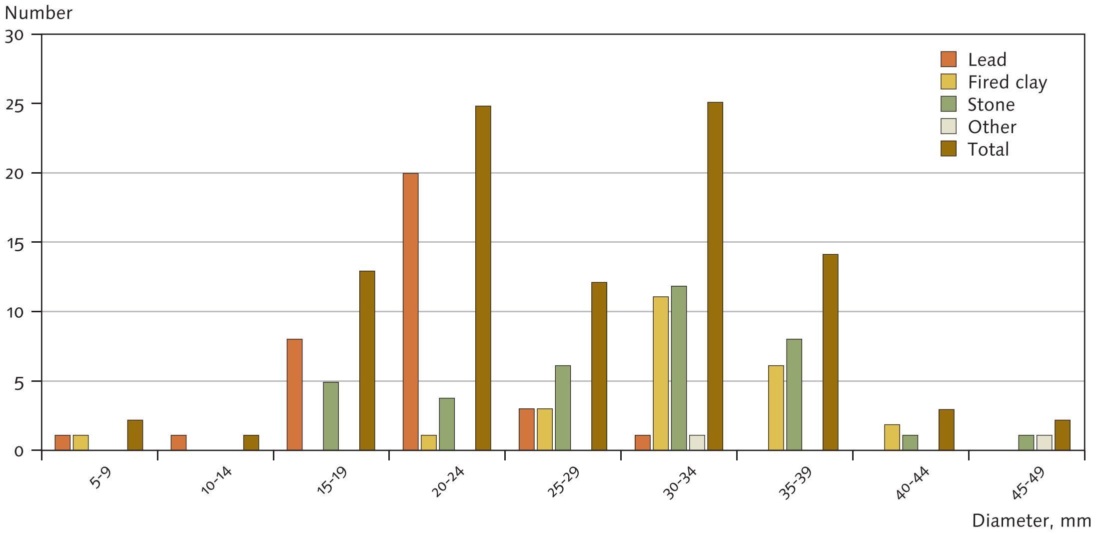
Figure 13.7 *Spindle-whorls from Kaupang 1998–2003: diameter in mm and material. N=98.*

Although the whorls' shapes are diverse, some forms are more frequent than others. Of the whorls of identifiable shape (N=117), nearly one-third are of hemispherical forms (A–B), while 37% are conical (C), 26% of flat forms (E–F), and only 5% are lentoid or biconical or have the form of a flattened sphere (D or G). Of the four unfinished whorls one has shape A (C52519/18484) and three shape E/F (C52519/10350, C52516/4283, C52516/560). A comparison of shape and material (Fig. 13.4) shows clearly that the choice of material is crucial to the shape of the whorl. Whorls of fired clay and lead are most often conical (C), while whorls of stone are mostly hemispherical (A or B) or flat (E or F).

The Kaupang assemblage contains an unexpectedly high proportion of lead spindle-whorls, 30% of the total, probably a reflex of the intensive metal-detecting (cf. p. 340). Six of these are incomplete, of which four are only represented by halves produced by deliberate cutting with a sharp tool, probably for secondary usage since these otherwise have the shape of spindle-whorls. Two of the cut lead whorls weigh around 20–24 g: C52519/2269 (20.2 g) and C52517/490 (23.5 g); the other two halved lead whorls are approximately half these weights: C52517/1964 (9.2 g) and C52519/15522 (12.4 g). Similar deliberate cutting has also been observed with other metal objects from Kaupang (cf. Pedersen 2008). Two of the artefacts that have been thought to be spindle-whorls have irregularities that render this functional identification doubtful. One of these (C5217/1940: 12.8 g) has a minor arm-like extension and the other (C52517/643: 10.7 g) has a hole that is not completely open or has partly been filled with lead. Although these do not quite correspond with old weight standards of the ertog (8.93 g) and øre (26.79 g), they come close to Viking-period weights of 1 øre, weighing about 24 g, and ½ øre, c. 12g (Skaare 1976; Kilger 2008b:280). These can therefore be interpreted as secondary weights that originally were used as spindle-whorls.

Although the material is quite fragmentary, it has been possible to weigh and calculate the weight, within intervals of 5 g, of a total of 111 whorls (Figs. 13.5–6). Of these, 67 are complete or nearly complete and 44 are represented by a half, a third or a quarter of the whorl, so that the weight can be estimated. Figure 13.6 shows that the spindle-whorls had





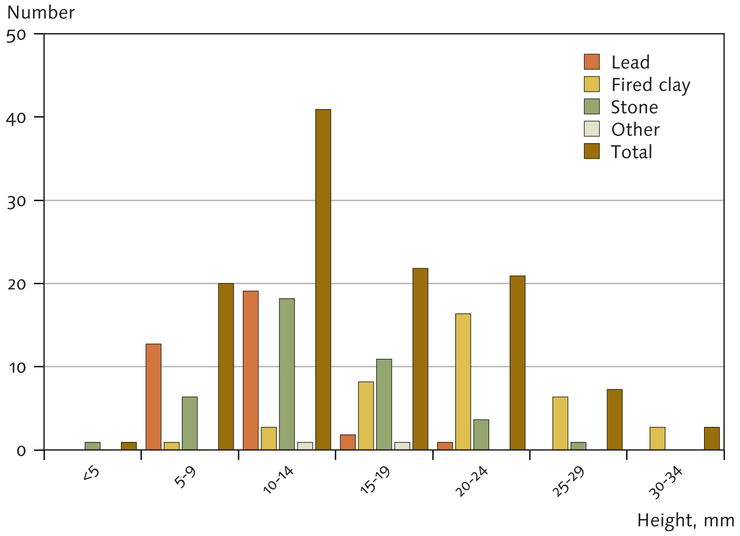
weights ranging from c. 3 g to 56 g. The lightest are of fired clay and stone and the heaviest, over 40 g, are lead. Whorls weighing 15–29 g are the most common, with a peak in the weight-group 20–24 g. The majority (93%) weigh less than 40 g, and only two more than 50 g.

The comparison between the weight of the spindle-whorls and the material they are made of (Fig. 13.6) shows different patterns. The whorls of fired clay are generally the lightest with a peak in the weight-group 15–19 g. The stone whorls demonstrate a similar curve, but with a peak from 20 to 24 g. The lead whorls are generally heavier and with a wider weight distribution, from 10 to 55 g, yet have a peak in the lightest weight-group at 10–14 g.

Lead was thus used both for fairly light and heavier whorls, from about 10 to 56 g. As already noted, some of the heaviest lead whorls had been cut into halves and at the time of deposition could not have been used for spinning. It is also possible that not all of them were used for spinning – a question that will be considered further when analysing their other morphological features. Three of the objects within the lightest weight-group under 5 g and one weighing 6 g are considered as improbable spindle-whorls because of their asymmetrical form and a hole that is not centred (cf. above, 13.1.1).

It has been possible to measure and calculate the diameter of 98 spindle-whorls. The diagram (Fig. 13.7) shows a variation in diameter of 9–47 mm with a concentration between 20 and 39 mm. The comparison of the diameter of spindle-whorls and the material they are made of shows that whorls of a heavy material such as lead were generally smaller than those of stone and fired clay, able to spin tight and strong threads. It is, however, more demanding to spin with a heavy whorl with a small diameter than with a whorl with wider diameter, partly because it is harder to spin threads of the same strength (pers. comm., Eva Andersson 2007).

Maximum height has been measured on a total of 115 of the spindle-whorls (Fig. 13.8). The height varies between 4 and 31 mm, with the majority between 10 and 24 mm. A comparison of the height of the spindle-whorls and material again demonstrates that the lead whorls are generally lower than the stone whorls, while those of fired clay are the highest. These differences in size, material and weight



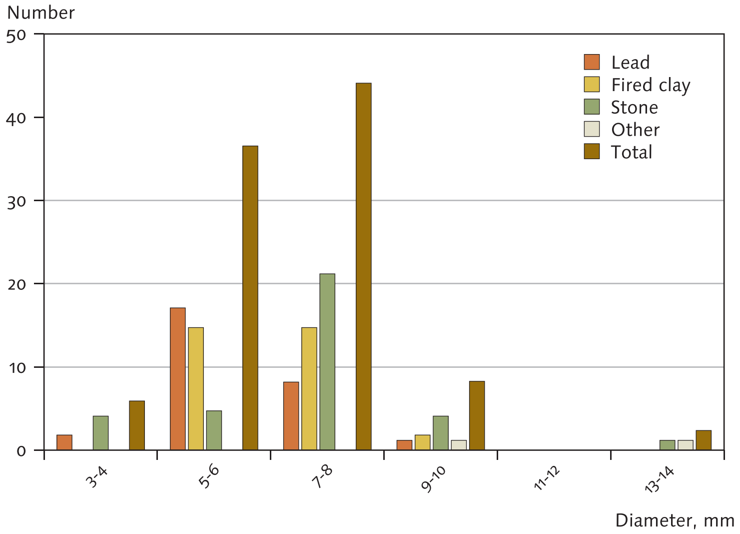


Figure 13.8 *All recorded spindle-whorls 1998–2003: maximum height and material. N=115.*

Figure 13.9 *Spindle-whorls from Kaupang 1998–2003: diameter of the hole and material. N=96.*

Figure 13.10 *Rough-outs Nos. C52519/18484, C52519/10350, C52516/560. Photo, Eirik Irgens Johnsen, KHM*

are all relevant to the quality of the threads, and many of the relatively small lead whorls should have been efficient when spinning tight threads of different fineness – qualities that were also dependent upon the spinner's abilities and skill. The biggest and heaviest spindle-whorls may also have been used when plying threads.

The size of the spindle-hole often co-varies with the size of the spindle-whorl, while at the same time reflecting the range of thicknesses of the rods. The diameter of the spindle-hole (Fig. 13.9) varies a great deal, between 3 and 13 mm on the measurable whorls, with a concentration around 5–8 mm. When correlating the hole and the material there is also a correspondence with the general size: whorls of lead are usually smaller than those of stone and fired clay, while the holes in stone whorls are often on the wider side, 7–8 mm as the most frequent size. The shape of the hole is often slightly conical, tapering upwards, the narrowest part serving as a grip, but parallel-sided holes also occur. These features also correspond to a large extent with the shape and size of spindle-holes in the finds from Birka, with a cluster of holes of 7–12 mm in diameter (Andersson 2003:79), and later medieval spindle-whorls from Bryggen in Bergen (Øye 1988:42), where rods of wood have also been found, some c. 20–30 cm in length. The thickness of these rods at the lower and upper points where the spindle-whorls would sit is 3–7 mm. There are also some smaller spindles, 11–15 cm long, and around 5–7 mm thick (Øye 1988:36–7). Rods of similar dimensions have also been found in Hedeby, and interestingly enough these also have traces of wear, demonstrating that the spindle-whorls were fastened 35–45 mm from the tip of the rod (Andersson 2003:125–6).

In order to give an even spin to the drop-spindle, the hole in the spindle-whorl ought to be absolutely central. Not all of the spindle-whorls from Kaupang fulfil this requirement. Some of the artefacts that have been considered to be spindle-whorls have irregularities with regard to centricity – being neither perfectly circular nor absolutely centric. This applies to nine (25%) of the 36 lead artefacts and twelve (14%) of the 85 spindle-whorls of stone or fired clay. Of the nine irregular lead spindle-whorls six have a somewhat uneven shape and three have imperfectly centred holes. Nearly all types are represented: A (1), C (4), E (3) and F (1). Only one of these belongs to the group of cut whorls; the others are complete. These cannot have been optimal for spinning. They might still have been used as spindle-whorls. A high proportion of the later spindle-whorls from Bryggen (43%) did not have a completely central spindle-hole, so that a deviation of 1–2 mm from absolute centricity could have been an acceptable margin (Øye 1988:42). The lighter the whorl, the greater was the need for centricity.

In addition, twelve (14%) of the 85 spindle-whorls of stone or fired clay either have a rather uneven shape (6 examples) or holes that are not completely central (6 examples). Four of the artefacts of uneven shape are amongst the very small and light whorls, weighing between c. 3 and 7 g, and of the simplest,

flat forms (E and F): one of sandstone (C52519/9748), two of steatite (C5219/10431, 11572) and one of fired clay (C52517/1003). The five with holes that are not fully centred are generally heavier and in the commonest weight-groups, weighing between 16 and 35 g. Three are made of steatite (types A, C and E), one of sandstone (F) and one of fired clay (C). The interpretation of the light and irregularly shaped artefacts as spindle-whorls may therefore be questioned, as they could hardly be good for spinning. That may also explain why they were discarded. I have therefore omitted from further analysis four of the light whorls of uneven shape noted and referred to by their ID number above.

Only two of the whorls are decorated, both of bone, in form of ring-and-dot decoration and concentric circles. On the whole, the spindle-whorls from the fieldwork of 1998–2003 at Kaupang appear as simple, utilitarian objects, with no extra decorative elements, unlike many of the spindle-whorls recorded in Viking-period burial contexts (Petersen 1951:307–8; Øye 1988:52).

To sum up, then, the variance in weight and the concentrations around certain weights and weight-groups reflect a variety of uses for the spindle-whorls. The range, from less than 5 g to around 50 g, shows that they were made to produce yarns of different degrees of fineness and strength. The majority of the whorls from the 1998–2003 fieldwork (79%) weighed less than 35 g, with a concentration around 20–24 g, and were probably used for spinning relatively fine qualities of wool. Some of the lightest whorls, in at least four cases, perhaps more, cannot have been good for spinning because of their irregular form and off-centre holes. They were probably discarded as a result, and could be interpreted as unsuccessful attempts at making spindle-whorls. They would thus reflect local production, since such objects would hardly have been traded.

Evidence of production

The four unfinished whorls also give us an insight into how they were made. Drilling the hole seems to have been a critical phase. The cylindrical piece of sandstone seems to have broken in two halves when the hole was drilled from the upper surface, the most practical way for the rounded spindle-whorls. With half weighing nearly 25 g, it would have been amongst the heaviest whorls at Kaupang. The same seems to have happened with one of the unfinished steatite whorls (type A) when starting to drill the hole from the base, after the hemispherical shape had been finished for an intended whorl of c. 20 g. Another intended whorl of steatite of type E of about 30 g was abandoned just after the drilling had started. The fourth rough-out is a piece of a steatite vessel apparently intended for a spindle-whorl of the same weight-group, but not a successful example (Fig. 13.10).

Some of the spindle-whorls of fired clay seem to have been poorly fired and have left a broken surface. At least five specimens clearly demonstrate this problem. Another feature that can be observed is the slightly conical shape of the spindle-hole, often measuring 1 mm less at the top, probably serving as a grip on the spindle.

Shape	Steatite	Other stone	Fired clay	Unidentified
Hemispherical (A–B)	8	3	4	
Conical (C)			2	1
Biconical (D)			1	1
Flat (E–F)	1	5		
Flat spheroid (G)			1	
Unidentified	4			1

Table 13.2 *Spindle-whorls from Blindheim's excavations of 1956–1974: material and shape. N=32.*

Other finds of spindle-whorls from Kaupang

Blindheim's settlement excavations of 1956–1974 also unearthed several spindle-whorls that must be considered to provide a fuller account of the Kaupang textile-production equipment.[1]

Altogether Blindheim's settlement excavations provided significantly fewer spindle-whorls, a minimum 32. Table 13.2 is based on references in Blindheim's publications and my own analysis of the examples that can be studied in the museum.[1]

The majority of the whorls that can be identified in terms of material (29 examples) are made of different types of stone – sandstone, schist, and mostly steatite – and the rest are fired clay. Lead and bone are unrepresented. The same shapes as recorded at the 1998–2003 excavations are represented, however: about half have hemispherical shapes and six flat forms, with considerably lower amounts of conical shapes, biconicals and flattened spheroids.

The measurable spindle-whorls vary in diameter from 19 mm to 43, most of them being between 25 and 44 mm with a peak around 30–34 mm (Fig. 13.11). This is a more limited size-range than the spindle-whorls from the 1998–2003 fieldwork. Their heights vary from 6 to 27 mm, mostly between 10 and 19 mm; about the same range as the whorls from the 1998–2003 fieldwork.

More or less the same weight-groups are represented, from c. 5 g to 38, but there are two considerably heavier whorls, c. 90 g and nearly 200 g respectively (Fig. 13.12). Half of the spindle-whorls weigh less than 20 g, and the group is thus generally lighter than the spindle-whorls from the 1998–2003 fieldwork, with 38% of the whorls lighter than 20 g (Fig. 13.13; cf. Fig. 13.6). There is also a higher percentage of complete whorls in Blindheim's material: 62% compared with 52% from the 1998–2003 fieldwork, probably reflecting differences in excavation methods but also differences in material. Although there is a higher proportion of whorls of stone and some differences in weights and sizes (cf. Figs. 13.7–8), the material is too sparse to draw significant conclusions about differences between the spindle-whorls from the two excavation campaigns.

Stylegar's catalogue refers to 27 datable finds of spindle-whorls found in 18 burials (Ka. 3, 10, 16, 154, 218, 250, 265, 268, 282, 284, 285, 295, 299, 301, 303, 306, 310 and 406) and seven stray finds, probably from disturbed graves (K/1950e, K/1950f, K/1950g, K/1950g, K/1951e, K/1954k and K/1954l), out of 116 closely datable burials in all (Stylegar 2007:78). One of them, however, Ka. 285, does not contain spindle-whorls according to Blindheim's records. Three objects referred to by Blindheim as either possible spindle-whorls or beads made of amber and glass in Ka. 284 and K/1951e should be regarded as beads on the basis of their shape, small size and weight of c. 2–3 g. One artefact in Ka. 321 which Blindheim regarded as either a bead or a spindle-whorl (Blindheim et al. 1981:49) is, however, counted as a spindle-whorl although it is not listed in Stylegar's catalogue.

The textile-production equipment that has been examined or otherwise documented reveals some differences between the finds from the burials and the settlement areas, in material, shape, size and weight.[2] Stone whorls are proportionately more frequent in the graves than in the settlement areas. Of the seventeen stone whorls, nine are made of steatite and eight of other stone, sandstone or some hard mineral such as serpentine or jet.[3] Spindle-whorls of fired clay are less frequent in the graves, with only seven examples. Flat and hemispherical forms are the most common types amongst the grave goods, while conical examples are rare. Generally, the spindle-whorls from the graves are more carefully made and the stone whorls represent more investment of

1 Eva Andersson (2003:132–3) refers to 37 spindle-whorls from Blindheim's settlement excavations of 1956–1974. I have only been able to record 24 spindle-whorls in the exhibition and store rooms at University Museum of Cultural History, including eight finds deposited in Bergen in connexion with Sigrid Kaland's analysis of the objects of steatite from Blindheim's settlement excavations.

2 Of the spindle-whorls from graves I have been able to check the weight of only seventeen, as not all could be located in the museum.

3 No petrographical analysis has been carried out, and the identifications are those of Blindheim.

Shape	Steatite	Other stone	Fired clay	Bone
A–B	4 (Ka. 10, 250, 295, 310)	3 (Ka. 282 K/1950f, K/1954l)	5 (Ka. 16, 218, 295, K/1950g, K/1950g)	1 (Ka. 282?)
C		1 (Ka. 299)	2 (Ka. 16, K/1954k)	
D			1 (Ka. 406)	
E–F	5 (Ka. 268, 282, 301, 303, K/1950e)	3 (Ka. 265, 284, 306)	1 (Ka. 3)	
G		2 (Ka. 321, K/1950f)		

Table 13.3 *Spindle-whorls from graves: material and shape. N=27*

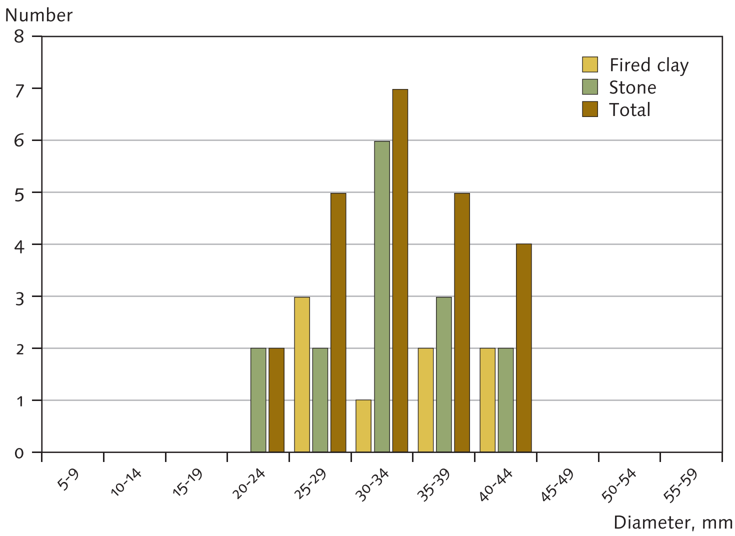
labour, with some more uncommon minerals such as serpentine and jet. Three of the spindle-whorls from burials are decorated, all with incised concentric circles. These were made of sandstone, serpentine and jet (Ka. 3, 154 and 299).

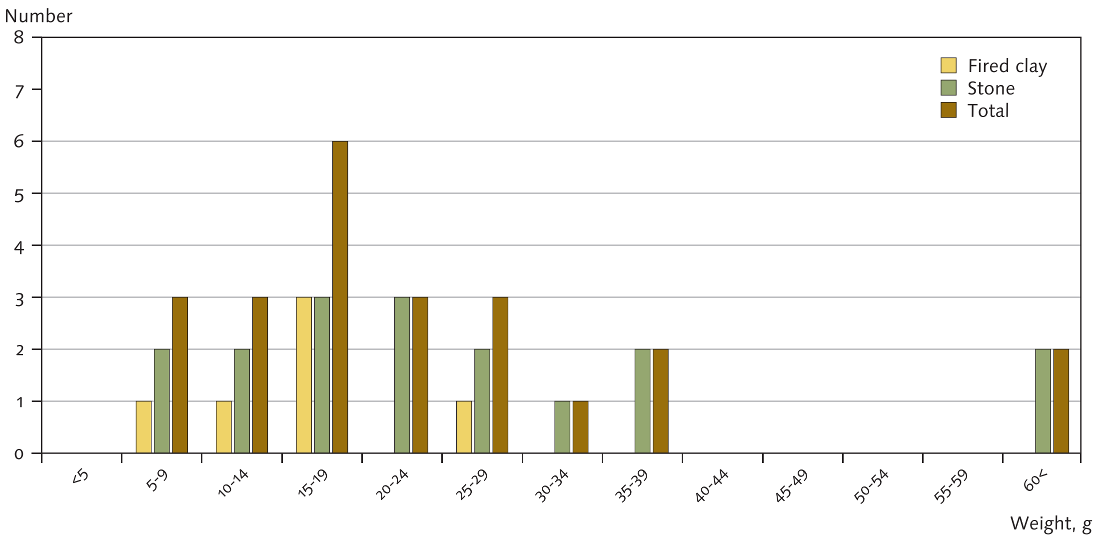
The spindle-whorls also differ somewhat in size and weight from those from the settlement areas, with a smaller range in diameter (cf. Fig. 13.13). Although their weights vary from around 5 g to more than 50, only a few of the measurable spindle-whorls from graves weigh less than 20 g and they are generally somewhat heavier than those from the settlement area. Nearly all of the spindle-whorls in the graves are complete and are precisely formed in respect of centricity – thus differing from the plainer and, in several cases, less precise or defective spindle-whorls from the settlement area. These differences also reflect a difference between intentional deposition and the lost, damaged and discarded artefacts reflecting constant activity in the town.

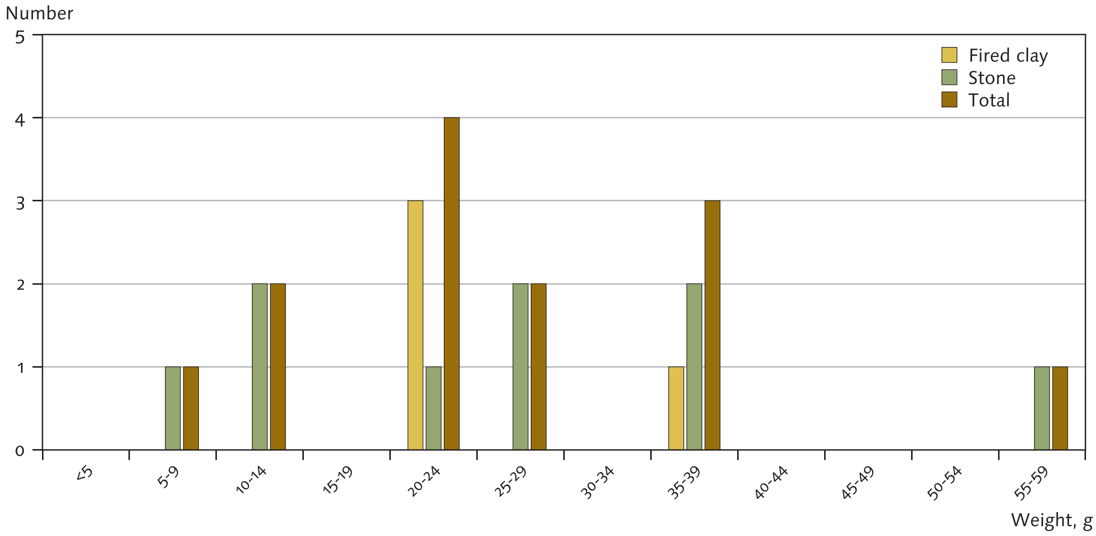
Blindheim also mentions rods in grave Ka. 218 and stray find K/19510 (Blindheim et al. 1995:51–2 and 65), but with no further information on their form, size or material. As they cannot now be retrieved, their function as spindles cannot be assessed.

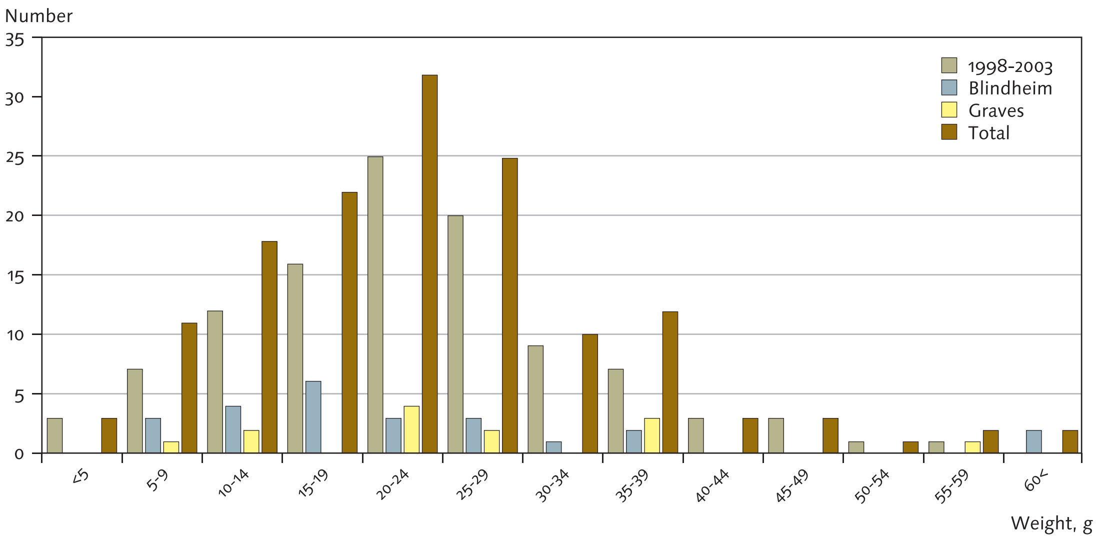
Figure 13.11 *Spindle-whorls from Blindheim's excavations of 1956–1974: diameter in mm. N=23.*

Figure 13.12 *Blindheim's settlement excavations 1956–1974; number of spindle-whorls per weight-group. N=24.*









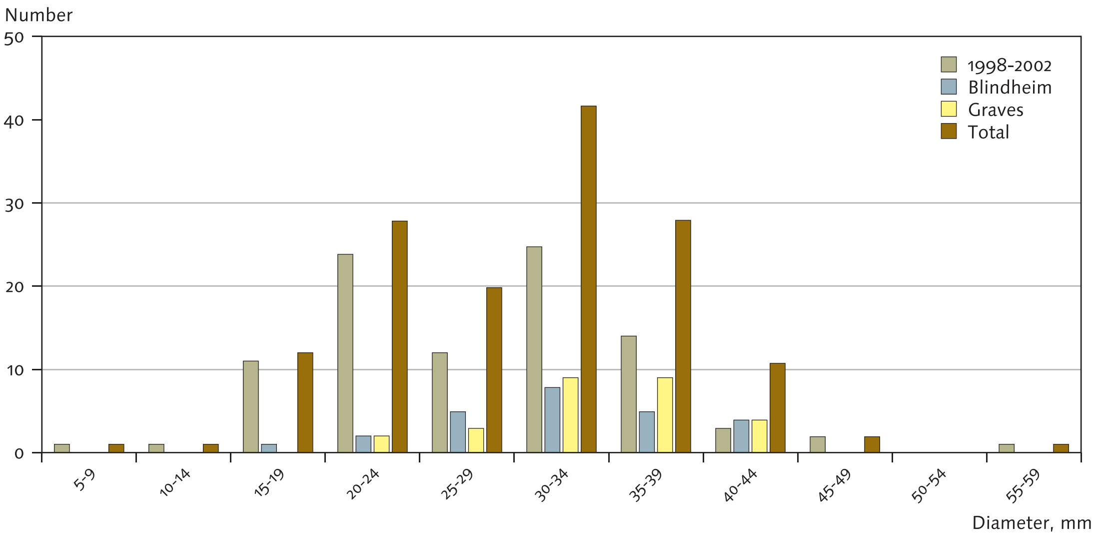


Figure 13.13 *Spindle-whorls recorded in graves at Kaupang by weight-group. N=17.*

Figure 13.14 *All measurable spindle-whorls from Kaupang by weight-group. N=149.*

Figure 13.15 *All measurable spindle-whorls from Kaupang by diameter. N=147.*

Site	Stone	Fired clay	Lead	Bone	Unidentified	Sum
1998–2003	37	40	36	2	1	117
Blindheim's excavations	21	8	-		3	32
Graves	18	8	-	1		27
Totals	76	56	36	3	4	176

Table 13.4 *All spindle-whorls from Kaupang by material. N = 176.*

Site	Hemispherical	Conical	Flat	Other	Unidentified	Sum
1998–2003	37	40	36	2	1	117
Blindheim's excavations	15	3	6	3	5	32
Graves	13	1	9	2	-	27
Totals	65	44	51	7	6	176

Table 13.5 *All spindle-whorls from Kaupang by shape. N = 176.*

All the spindle-whorls from Kaupang

When evaluating all the spindle-whorls recorded at Kaupang as a group, some of the objects that have been analysed so far should be discounted as equipment for textile production: four artefacts from the 1998–2003 fieldwork, three of stone and one of fired clay (cf. p. 347), and three of the objects from the graves and stray finds which should in fact be counted as beads: two of amber (Ka. 285, K/1951e) and one of glass (Ka. 284). The total number of objects interpreted as spindle-whorls at Kaupang thus comprises 176 objects (Tab. 13.4), of which 172 are of an identifiable material.

Altogether 43% of the whorls are made of stone, 32% of fired clay, 21% of lead, 2% of bone, and 2% are of some unidentified material.

As a group, the spindle-whorls from different sites and contexts at Kaupang demonstrate a more or less consistent pattern of weight distribution within a range from 5–10 g to around 55 g for the positively identified spindle-whorls. However the majority (62%) weigh less than 30 g, with a peak around 20–24 g.

Most of the spindle-whorls (76%) from Kaupang have a diameter of 20–40 mm with a peak from 30 to 35 mm (Fig. 13.15) but, as we have seen, there is some discrepancy between spindle-whorls from the two settlement excavation campaigns and the cemeteries.

As a whole, the spindle-whorls from the 1998–2003 fieldwork represent a broader spectrum of materials, types, sizes and weights than the spindle-whorls from Blindheim's settlement excavations. This is probably due to different excavation methods, with the 1998–2003 finds apparently a more representative assemblage than those from the earlier excavations which had less sophisticated methods. The spindle-whorls from the graves show a divergent pattern, with proportionately more stone whorls of different minerals and more elaborate forms. The differences also reflect the practices, activities and casual deposition in the settlement areas in contrast to the intentional and deliberate deposition of grave goods.

13.2.2 Loomweights from the settlement area

Altogether 611 find-units were recovered during the 1998–2003 fieldwork including both fragments and complete or nearly complete loomweights. Nearly all of them are made of fired clay (594 find-units), eight of dried clay, and only nine specimens are of stone: four of steatite, three of schist, one of sandstone and one of an unidentified mineral. The function of these as loomweights cannot, however, be conclusively determined as they may also have functioned as netsinkers (cf. Olsen 2004; Baug, this vol. Ch. 12:324). Two of the steatite weights are re-used pieces of steatite vessels (C52264/30 and C52167/10), both weighing around 140 g. The more complete weights of schist and sandstone weigh in the range of 300–650 g.

The loomweights of clay are generally highly fragmentary, comprising around 2,700 fragments in all, altogether weighing c. 47 kg. The number of fragments per find-unit varies from a single piece to 140 fragments but is usually less than ten. The material will, however, be referred to by find-unit identification number. Only eleven of the loomweights are complete or nearly complete, and seventeen are represented by a half, a third or a quarter of the loomweight, thus making it possible to measure or estimate the original weight of 28 examples.

It is, however, impossible to decide how many loomweights each number represents – it can be one or several, while in some instances the identification of loomweights may be difficult. Fragmentary loomweights of fired clay may, for example, be difficult to distinguish from tuyères (e.g. C52519/11148). In most

cases distinguishable features such as the form and the hole aid identification. I have, however, relied on the identification done in the field, based both on features of this kind and the find-context.

The actual number of loomweights represented is higher than the number of find-units. In one find-unit, C52516/1444 containing c.140 fragments weighing about 2 kg, a whole loom may be represented. 28 or 29 loomweights could be identified by the holes in the fragments but only one complete specimen, albeit broken in two (10 cm in diameter), and another preserved as a half. Similar numbers are common when weaving with an upright loom (Mårtenssson et al. 2006c:9) and correspond to the numbers of loomweights found in the few Viking-period graves where not just one loomweight but a whole loom is represented (Petersen 1951:295), and in later medieval contexts. At Bryggen a set of 25 loomweights has been found in situ in one of the burnt buildings (Øye 1988:122–3). The remains of a loom (C52519/16422) are represented by a cluster of five, perhaps six loomweights, of which three were nearly complete, c. 9–10 cm in diameter and weighing between 312 and 340 g (Fig. 13.16). One find-unit, C52519/18601, comprises more than forty fragments (524 g) from at least two loomweights, one of which was preserved as a half of the weight, 10 cm in diameter and with a circular stamp decoration. Another find-unit, C52519/24380, comprises more than fifty fragments, weighing 1.4 kg, probably from four or more loomweights. One find-unit, C52519/22562, with more than twenty fragments (761 g) contains at least three loomweights, one 9 and one 10 cm in diameter. Another find-unit, C52519/13110, consists of four fragments (272 g), representing two weights, one of which had an imprint of textile decoration. C52519/20119 also comprises two loomweights (215 g), respectively 7.9 and 8 cm in diameter. Another find-unit, C52519/22968, with more than seventy fragments, weighing 973 g, comprises two or three weights, one of them c. 8 cm in diameter. These grouped finds thus involve quite similar loomweights in terms of size and weight, and seem to reflect weaving activities in the areas they were found.

There is a clear connexion between shape and material. Where shape can be identified, weights of fired clay are discoid while the weights of stone have more varied and haphazard forms, either with gently sloping or nearly parallel sides and a hole at the narrowest end, the longest of them being nearly 12 cm long, or more rectangular shapes.

The shape of the loomweights of fired clay appears to be more standardized than those of stone (Fig. 13.17). They nevertheless vary in size and weight. The diameter of the preserved or measurable clay loomweights (N= 63) varies from 7.8 to 13.2 cm. The majority, about 83% of the measurable weights, are 9–11 cm in diameter, with 14% around 8 cm and only 3% wider than c. 11 cm.

The maximum height measured on complete, nearly complete and other measurable loomweights varies more than the diameter, from 15 mm to 51, the majority lying between 22 and 40 mm (Fig. 13.18). These differences also affect their weight.

Figure 13.16 *Four of the loomweights found in a cluster (C52519/16422). Photo, Eirik Irgens Johnsen, KHM.*

Figure 13.17 *Diameter of fired-clay loomweights from Kaupang 1998–2003. N=63.*

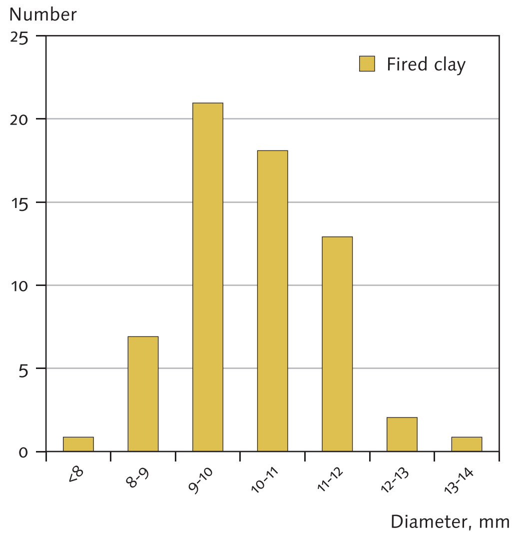
Figure 13.18 *Fired-clay loomweights from Kaupang 1998–2003: maximum height in mm. N=36.*

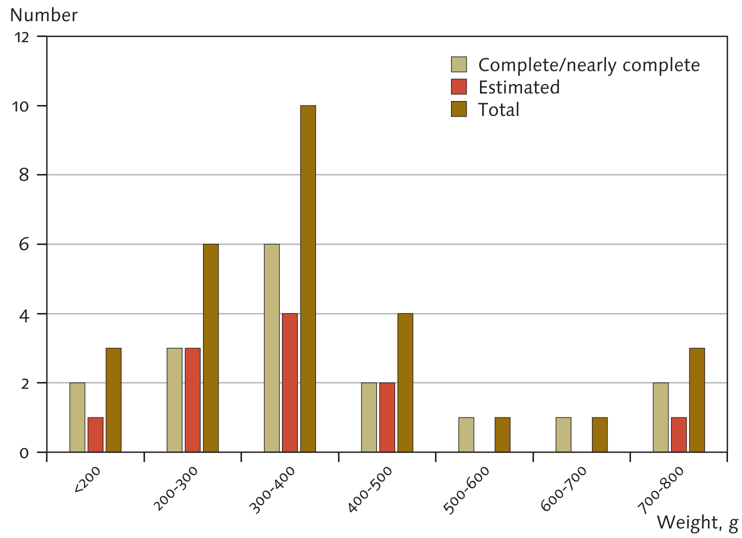
Figure 13.19 *Kaupang 1998–2003: number of loomweights per weight-group. N=28.*

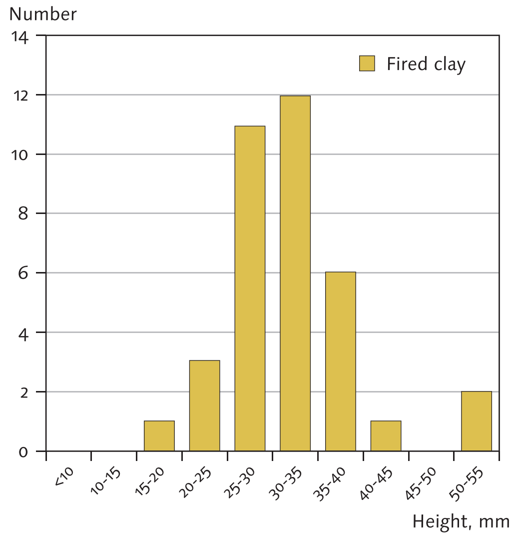
Figure 13.20 *Fired-clay loomweights from Kaupang 1998–2003: diameter of the hole. N=82.*

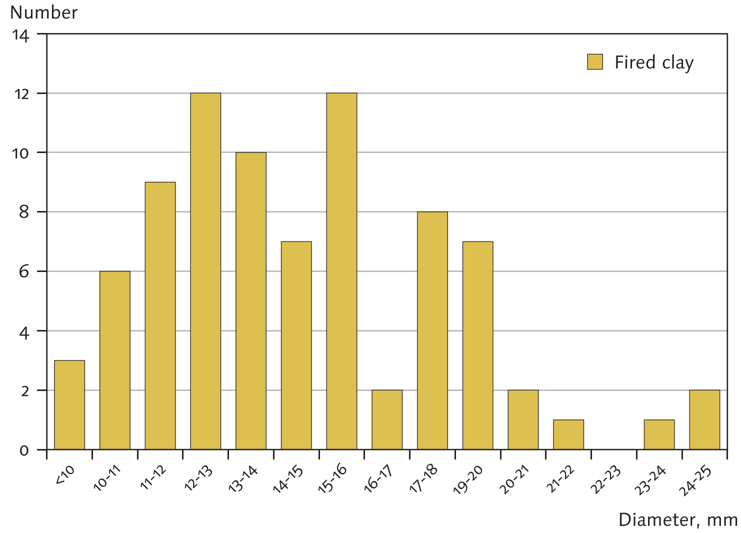
Eleven of the loomweights of fired clay are complete or nearly complete, weighing from c. 150 to nearly 800 g. When including loomweights whose weight can be estimated (N=17), the majority lie between 200 and 500 g (Fig. 13.19). Generally, complete weights tend to be heavier than those with estimated weights. So our estimates may be too low and a little inaccurate. Although the measurable examples are few, they demonstrate a fairly wide spectrum of weights reflecting significant functional differences and implying the weaving of different qualities of cloth.

Common to all loomweights is the hole through which the warp was tied. Altogether 82 of the loomweight-fragments have holes for the threads that can be measured, varying in diameter from 8 mm to 24 mm, the majority between 10 and 20 mm in diameter (Fig. 13.20). These are larger than the holes of later medieval loomweights which are generally only 4–6 mm (Øye 1988:64). In recent times, warp-threads were not tied through this hole but were attached by means of a looped cord through the hole of the loomweight (Hoffmann 1964:37). The size of









Stamp-impressions	Finger- prints	Comb-impressions	Lines	Textile-imprints	Dots	Grooves
18	10	5[4]	7	1	1[5]	2

Table 13.6 *Marks and stamps on loomweights from Kaupang 1998–2003.*

the hole does not therefore necessarily reflect the number of warp-threads attached to the weight. The bigger holes in the clay loomweight may, however, have been used for the direct attachment of the warp. Comparing the holes with the diameters of the loomweights, there is no clear correspondence between small holes and low weights or vice versa. The smallest weights have holes from 8 to 15 mm.

Forty-four (7%) of the find-units with loomweights of fired clay contain fragments that are decorated with different marks or stamps (Table 13.6).

Different stamps can be identified (Figs. 13.21–2). They can be formed as a small horseshoe (N=4, Fig. 13.21.1),[6] or as loop(s) ending in smaller loops (N=3),[7] as a four-leafed clover (N=1, Fig. 13.21.2),[8] as circles, often 6–7 mm in diameter (N=6, Fig. 13.21.3),[9] or as other stamp impressions (N=4, Fig. 13.21.7–10).[10] Imprints made by finger are also common at Kaupang (N=10, Fig. 13.21.5),[11] usually only one fingerprint, in one case two, and another with uneven imprints along the edge of the weight. Only one example of textile impressions has been identified, these being quadrants of 26 mm x 19 (C52519/13110, Fig. 13.21.4). Seven loomweights have incised lines (Fig. 13.21.6),[12] in one case two parallel lines, probably made with a small twig. Some of these lines may, however, be unintentional. One of the weights has a raised edge around the hole (C52519/146) and another (C52519/11382) a longitudinal groove. As the material is fragmentary it is not possible to observe any clear correlations of weight, size and stamp. Only three defective loomweights with imprints had measurable diameters: two with fingerprints at 8.7 and c. 11 cm respectively and one with a stamp-impression (a horse), c. 9 cm in diameter. The stamps may, however, reflect some professional production of loomweights and could perhaps be a producer's trademark.

Blindheim's finds of loomweights

Blindheim's settlement excavations of 1956–74 also unearthed a lot of loomweights. This forms the largest collection of textile-production equipment amongst her finds, recorded as 202 find-units altogether, and weighing more than 20 kg in total.[13] One of the find-units included at least nineteen unfired clay weights found in a cluster (C52502) in one of the structures interpreted by Roar Tollnes as "Hus III" (re-interpreted in Pilø 2007d:211–17), implying that the total assemblage from her excavation campaign included at least 221 loomweights, and probably more. The find-units of fired clay generally include far fewer fragments than from the 1998–2003 fieldwork: only seventeen contain more than ten fragments, ranging from 11 to 35, and only one find-unit more (250 fragments). This apparently reflects different excavation methods rather than differences in the archaeological record as such, as Blindheim did not sieve the soil. This may also explain why the loomweights were generally more complete; 21 being nearly complete or complete and twelve preserved as halves. Altogether, it was possible to measure the weights and size of 35 loomweights within intervals of 100 g, representing 16% of the minimum number of loomweights found, compared with 5% of the find-units from 1998–2003.

The weights vary between around 150 and 500 g, the majority between 300 and 500 g, with a peak between 300 and 400 g (Fig. 13.23). Twelve complete loomweights were made of steatite, either pear-shaped or rectangular, weighing from c. 280 to 700 g,[14] with c. 300–350 g as the most common weight-group. This group apart, steatite is seldom used for loomweights at Kaupang. Apart from the set of nineteen unfinished weights of dried clay, all the rest

4 C52519/19790, C52519/1144, C52519/23875, C52519/21601, C52519/24589.

5 C52519/1708.

6 C52519/9390, C52519/10308, C52519/9790, C52519/22040.

7 C52519/11168, C52519/12684, C52519/22538.

8 C52519/28727.

9 C52519/12060, C52519/11982, C52519/18601, C52519/28419, C52519/2470, C52519/11982.

10 C52519/11020, C52519/22562, C52519/13349, C52519/21708.

11 C52519/2788, C52519/12971, C52519/12914, C52519/25245, C52519/1607, C52519/12983. C52519/27600, C52519/21708, C52519/38542, C52519/187.

12 C52519/11086, C52519/25913, C52519/16566, C52519/24826, C52519/23721, C52519/23693, C52519/28253.

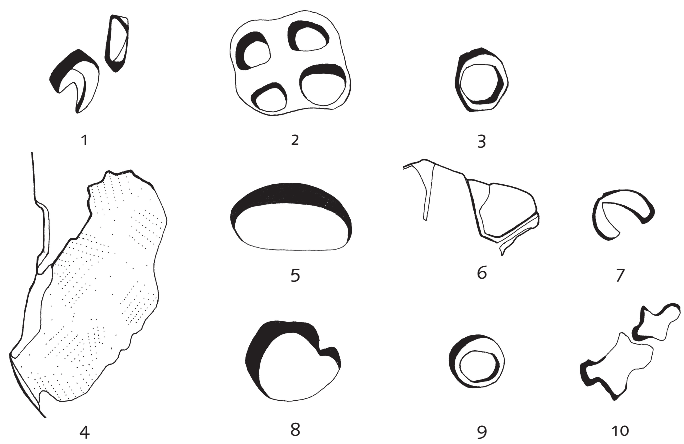
13 Eva Andersson refers to 227 weights, 197 of fired clay and 20 of steatite, plus a further 10. It is unclear whether these figures represent find-units or the number of pieces, and for the rest material is not referred to.

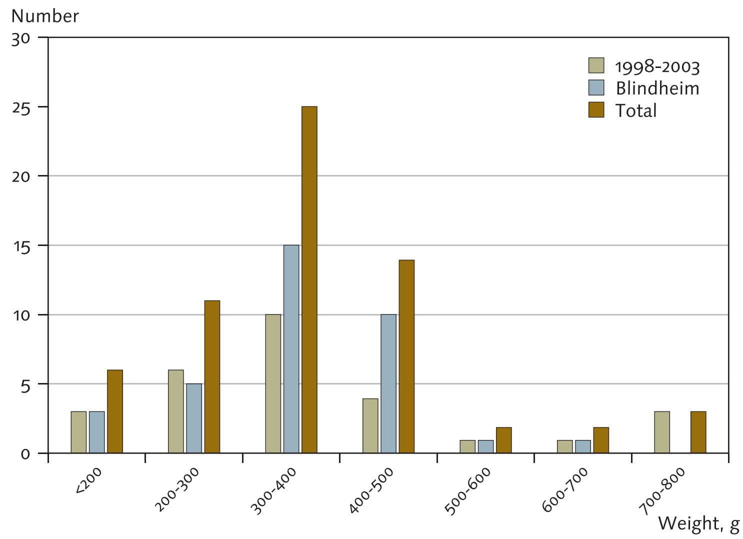
14 Mo 1960=Murområdet, named after a stone wall discovered in one of the ditches (Tollnes 1998:17). Seven of these could not be measured as they were on exhibition. All of them are small specimens, probably weighing less than 200 g.

Figure 13.21 *Different types of stamps and imprints on loomweights from Kaupang:* **1.** *horseshoe (C52519/9390);* **2.** *four-leafed clover (C52519/28727);* **3.** *circles (C52519/12060);* **4.** *textile impression (C52519/13110);* **5.** *finger print (C52519/2788),* **6.** *lines (C52519/11086);* **7-10.** *other (C52519/11020, C52519/22562, C52519/13349, C52519/21708). (Scale 1:1). Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 13.22 *Imprints on loomweights from Kaupang. Photo, Eirik Irgens Johnsen, KHM.*

Figure 13.23 *All measurable loomweights from Kaupang by weight. N=63.*





were fired clay and of discoid shape, varying in colour from different shades of red to grey.

Although equipment for textile production occurs quite frequently as grave goods in Norway, loomweights appear less often except in Hordaland and Sogn og Fjordane in western Norway (Petersen 1951:296). In Kaupang only a fragment of a loomweight has been found in a grave (Ka. 283) but there is no information on its material, shape or size (Blindheim et al. 1995:83), and there are two possible loomweights of fired clay as stray finds possibly from disturbed graves. The use of clay may be regarded as culturally distinctive, with more affiliations to the south and east of the country and the area of medieval Denmark, including Skåne. Loomweights from medieval Oslo differ from those in other urban con-

texts such as Bergen and Trondheim, with 52% in clay while nearly all in the other medieval towns of Norway were made of stone (Rui 1991:127).

On the whole, circular loomweights of fired clay seem to have been the normal loomweighs at Kaupang, and were apparently produced, at least partly, in the town itself. Although the finds are highly fragmented, it is possible to distinguish size- and weight-groups, showing that they were used to produce different types of cloth, both finer and coarser.

13.2.3 Weaving battens

Only one iron weaving batten (C52516/6442) was uncovered during the fieldwork of 1998–2003, represented by a blade found in seven pieces. A chisel-shaped object of iron (C52516/38573), 89 mm in length (like Petersen 1951:303: Norw. *vevreell*), may have been used for weaving, but this is very uncertain. As mentioned earlier, the conditions for the preservation of metal were generally poor, and larger objects of valuable metal were seldom discarded intentionally.

The graves, however, represent intentional deposition. Seven burials contain a total of eight weaving battens according to Stylegar's catalogue (Ka. 10, 14, 16, 22, 253, 255 and 294),[15] and there is one further doubtful case (Ka. 302). However Ka. 255 can also be questioned. Although they are severely corroded, two of these that are more or less complete are both more than c. 50 cm in length, and a third more than 60 cm. Two of the weaving battens belong to types JP 155 (= R440) and JP 156, while two more are like JP 155. Ka. 22 has a different form, with a shorter blade and a long tang. The weaving battens from Kaupang are thus more or less of the same size as iron weaving battens from the period, 50–80 cm in length (Petersen 1951:290). They could probably be used to make strong fabrics like sailcloth.

13.2.4 Needles and needle-cases

A total of 45 objects from the 1998–2003 fieldwork have been identified as needles or possible needles: 11 of iron, 13 of bone and 21 of bronze or copper alloy. The metal needles are generally very fragmentary and difficult to identify with any certainty. At least nine of them were more probably parts of buckles or clasps. The measurable pins of iron vary from 56 to 81 mm in length, and those of copper alloy from 21 to 98 mm. The needles of bone are the most fragmented, usually represented by small fragments either of their heads (N=5), the shaft (N=5) or the point (N=1). All are too fragmentary to be measured for length. The shape of the head varies. Two have a spatulate head widest at the upper edge (C52516/5230, C52519/11970). Two have a relatively small, rounded head of oval cross-section (C52516/5230, C52519/1175), and there is a third type on which the head runs straight down to the shaft, or has a wider head, either rounded or rhomboidal (Fig. 13.24, C52516/2608). The widest point is at the needle's eye and the head curves into the shaft. The width of the head on the bone needles varies from 11 to 14 mm and the diameter of the eye from 2 to 4 mm. The diameter of the stem, 4–6 mm, indicates that these were rather small. Needles of the same type have been found in Birka and Hedeby and later medieval urban contexts. They may have been used for stitching coarser textiles or for single-needle knitting (Øye 1988:98–9; Andersson 2003:127–8). Although some of the metal needles may also have been used as sewing needles or pins, the evidence is too insecure for further discussion in terms of textile production.

Figure 13.24 *A fragment of a bone needle (C52516/2608 1.9 cm) and a copper-alloy case for pins or sewing needles (C52517/997, 3.4 cm). Photo, Eirik Irgens Johnsen, KHM.*

Figure 13.25 *Two pairs of shears from Kaupang 1998–2003 (C52516/4084, 17.9 cm; C52516/158, 11.7 cm). Photo, Eirik Irgens Johnsen, KHM.*

A fragment of a cylindrical copper-alloy case for pins or sewing needles, with incised linear decoration, broken at both ends and now only 34 mm long and 8 mm in diameter (C52517/997), is a unique item amongst the Kaupang finds from the settlement area (Fig. 13.24). The same type of case has been found at Birka.

Needles found in graves are also few, and their function uncertain,[16] except for one iron needle in Ka. 218 that was apparently used for sewing. It is 74 mm long and 9 mm in diameter at the head, like a modern darning needle. It had a small wooden case attached to it for protecting the point (Blindheim et al. 1995:52). The bronze needle-case found in one

15 Ka. 14: tang without blade; Ka. 16: defective weaving batten tang, 13.1 cm long, 3.4 cm wide; Ka. 22: tang 18 cm long, 3.3 cm wide, iron weaving batten, strongly corroded; Ka. 253 more than 60 cm long, 4.2 cm wide, with a tang c. 16 cm long; Ka. 294: over 48 cm long, blade 4.7 cm wide, one-sided blade, tang nearly 20 cm long.

16 Ka. 268c is a bronze pin without a head, 103 mm long and 3 mm thick. C52505 is made of iron and only a small fragment of this small needle, the point, is preserved.

of the graves at Lamøya (Ka. 210: Blindheim et al. 1981:216, pl. 640), measured 62 mm in length and 8–11 mm in diameter with a small hole in the middle. It was thus longer than the incomplete case from the 1998–2003 fieldwork but the two may originally have been of approximately the same size. Another looped needle-case from Ka. 257 shares the same fine stripe-ornamentation, and both have Insular parallels (Blindheim et al. 1995:53).

Hones, including small hones for sharpening needles, are discussed by Heid Gjøstein Resi (this vol. Ch. 14) and therefore are not considered here.

13.2.5 Other textile-production equipment

Shears

Only two pairs of iron shears have been found during the fieldwork of 1998–2003, of which one is complete and of one of the typical Viking-period types, JP 268 (= R443), with a rounded spring (Fig. 13.25) and of medium size, c. 17 cm long. The other pair (C52516/158) is smaller, 11.7 cm long, but badly corroded. Jan Petersen's survey shows that shears normally vary between 19 and 25 cm long, but can reach up to nearly 40 cm. Long shears are found predominantly in male graves (Petersen 1951:318).

Site Period	SP I	SP II	SP III	SP I–III
Type	A	A (3), B/D (2), C (7), G (1) unidentified (2)	A(1), C (1), F (1)	C (5), F (1)
Material	Steatite	Clay (10), lead (1), steatite (3) sandstone (1)	Clay (1), steatite (1), lead (1)	Clay (5), steatite (1)
Weight (g)	14	7, 8 (2), 12, c. 15, c. 17, c. 20 (3), 21, c. 25, 36, 38, fragments (2)	22, 25, 27	c. 10, 17 (3), fragments (2)

Table 13.7 *Spindle-whorls from Kaupang MRE in relation to Site Period by type, material and weight. N = 26.*

Three fragments of shears are known from Blindheim's settlement excavations: two small corroded pieces of blades (C52505/2109, 232) and part of a handle 10.7 cm long (C52505/549) implying a large original.

Ten of the graves at Bikjholberget and Lamøya contained shears or possible shears (Ka. 6, 11, 16, 166, 204, 250, 252, 257, 285 and 302), one, maybe two of them, two pairs (Ka. 6 and 257).[17] I have been able to examine seven of the artefacts.[18] They differ in size but are too defective to be measured accurately. One of the pairs (Ka. 257) was originally kept in a case. Only two of the graves had shears in combination with any other equipment for textile production (Ka. 16 and 285), in both cases with spindle-whorls (cf. Tabs. 13.8–9).

Smoothing stones

Fragments of four smoothing stones, and four uncertain examples, were found during the fieldwork of 1998–2003 (Gaut, this vol. Ch. 9:Tab.9.17). Six of these are solid and the seventh, an uncertain specimen, is hollow. They are all made of medium to dark greenish-brown glass. As they are all very fragmentary, their identification relies on chemical analysis, with the glass identified as lead-potassium-silica glass. Similar items of the same material have been found in France, England and in urban contexts such as Hedeby and Novgorod (Gaut, this vol. Ch. 9:230–2).

Two possible solid smoothing stones, one of glass and another of stone, have also been found in graves (Ka. 27 and 307).[19] As both of these were found in male graves without any other equipment for textile production the identification is rather uncertain. Smoothing stones are normally found in female graves (Petersen 1951:329).

Tooth-shaped iron fragments from a possible linen heckle have also been found in one of the female graves (Ka. 285), but these are too fragmentary for this to count as certain identification.

13.3 The dating of textile-production equipment

As intact deposits were preserved over only a minor part of the settlement area (Pilø 2007b:149) because more recent agriculture has affected much of the site, so only a minority of the implements can be associated with stratified contexts. The majority of the datable finds from the excavations and surveys at Kaupang of 1998–2003 have been dated to the 9th century or the first half of the 10th century: Site Period I (c. AD 800–805/10), Site Period II (c. AD 805/10–840/50) and Site Period III (c. AD 840/850–c. 900). Site Period I (SP I) has been interpreted as an initial phase of temporary settlement, while Site Period II (SP II) represents the first permanent settlement at Kaupang albeit using plot-boundaries from SP I. There are few preserved deposits from Site Period III (SP III) and stratified material from this period is mostly secondary fill in pits, which also suggests that some of the material attributed to this period is residual. An assignation to SP I–III is used for artefacts which derive from intact deposits but cannot be related to specific site periods. Disturbed settlement deposits are found in later medieval plough-layer and the modern ploughsoil (Pedersen and Pilø 2007:184–6). The topsoil, however, is likely to have contained artefacts from destroyed phases. The artefactual record is therefore chronologically incomplete and artefacts from the earliest deposits are also found in the ploughsoil (Pilø 2007a:131, 2007b:149).

Only the finds from stratified layers related to SP I, II and/or III from the main research excavations

17 Ka. 6: possibly two pairs of shears; Ka. 11: fragment of a badly corroded pair; Ka. 16: part of a pair of shears (Petersen 1951:fig. 168), length 17 cm; Ka. 204: fragment of pair of shears; Ka. 250: blade, surviving length10.7 cm; Ka. 252: badly corroded pair of shears; Ka. 257: two pairs of shears; Ka. 285: pair of shears, surviving length 16.5 cm; Ka. 302: pair of shears, length 18 cm (Petersen 1951:fig. 168).

18 Ka. 285: small but not measurable; Ka. 257: relatively large but not measurable, with a possible case noted; Ka. 11: strongly corroded – only part of the hoop is preserved; Ka. 16: uncertain identification as a pair shears – 10 cm long with the blade only 5 mm wide, possibly from a pair of tweezers.

19 Ka. 307: rounded stone (granite), 5.8 cm in diamater.

20 In Table 12.3 weights are marked with "c." to denote the approximate weight.

21 Two of the spindle-whorls are stray finds, but Blindheim (et al. 1995:75) associates them with Ka. 282.

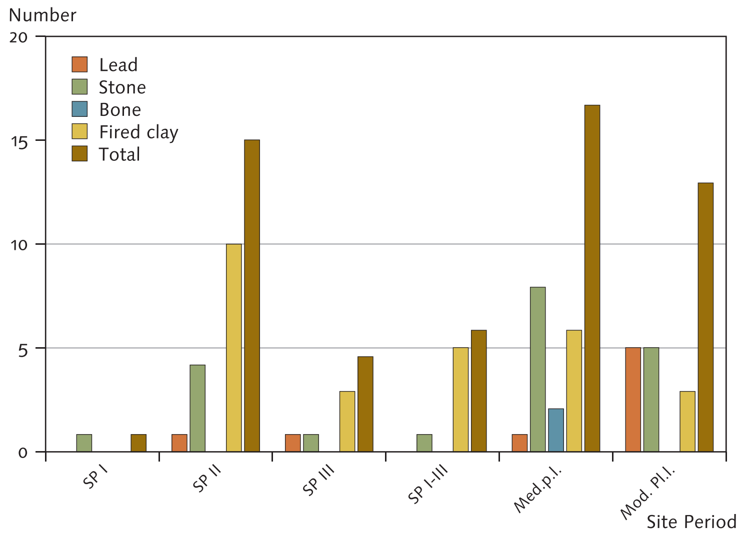


Figure 13.26 *Spindle-whorls from Kaupang MRE by Site Period or stratified context.*

of 2000–2 (MRE) and graves are considered here. The in situ find of 19 unfired and partly unfinished loomweights from one of the assumed buildings ("Hus III") in Blindheim's settlement excavations can probably be related to SP II (Pilø 2007d:213). Of the 116 datable graves, 98 can be dated with more or less certainty to either the 9th or the 10th century: 43 to the 9th and 55 to the 10th century (Stylegar 2007:80). Thirty-seven of these contain finds of textile-production equipment (cf. Tab. 13.8).

13.3.1 Spindle-whorls

Only about a fifth (24 specimens) of the objects discussed as spindle-whorls from the settlement area can be assigned to the datable site periods, SP I–III (Fig. 13.26), and thirty to the medieval and modern plough-layers. The remainders have no context in any distinguishable layer.

Just one spindle-whorl is associated with SP I, a complete steatite whorl of type A, 33 mm in diameter, 11 mm high and weighing 14.5 g, indicating the spinning of fine thread (Tab. 13.7).

Of the 16 spindle-whorls from SP II seven are complete, one is a rough-out, six are broken or damaged, and two are only preserved as fragments. The majority are made of fired clay, but some are of stone or lead. Types A, B, C and G are represented in this collection, ranging in weight from c. 8 g to 38.[20] Whorls of fired clay, stone and lead are also represented in SP III. Six of the spindle-whorls are related to SP I–III as a whole. The unfinished whorl of steatite (C52519/18484) is evidence of the production of spindle-whorls in the early 9th century.

The spindle-whorls from Blindheim's settlement excavation cannot be closely dated.

Altogether 43 items of textile-production equipment and four possible items have been recorded in 37 graves; there are also 9 items found as stray finds that may come from disturbed graves and cannot be dated. Of the 20 spindle-whorls found in graves, 19 can be dated within periods of 50–100 years from the early 9th century to around 950. Eight can be dated to the 9th century, of which three can be dated to the first half of the century, two to the second half, and three to the 9th century generally. Four spindle-whorls can be dated from the latter part of the 9th

Artefacts	800–850	800–900	850–900	850–950	900–950	900–1000	Undated
Spindle-whorls	Ka. 265, 268, 299	Ka. 250, 306, 310	Ka. 218, 301	Ka. 295 (2), 303, 406	Ka. 3, 16, 284, 321	Ka. 10, 282 (3)[21]	Ka. 154; stray finds: K/1950 (4), K/1954 (2)
Weaving battens	Ka. 255	Ka. 14, 253		Ka. 296	Ka. 16, 294, 302 (?)	Ka. 10, 22	
Shears		Ka. 204 (?), 250			Ka. 6, 11, 257 (2), 285, 302		Ka. 166, 252
Needles			Ka. 218				
Needle-cases	Ka. 210				Ka. 257		
Smoothing stones					Ka. 270, 307 (?)		
Loomweight				Ka. 283			2 stray finds

Table 13.8 *Datable textile-production equipment from graves at Kaupang. N = 43*

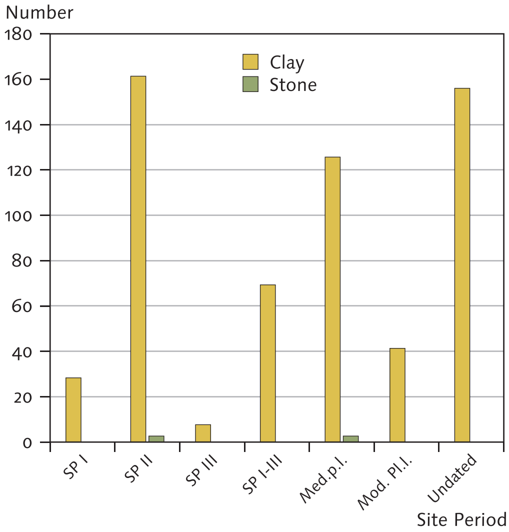


Figure 13.27 *Loomweights from Kaupang MRE by Site Period or stratified context.*

century to c. 950. Finally, there are eight that can be dated to the 10th century, four within the first half of the century and four to the 10th century generally (Tab. 13.8).

Different types of spindle-whorls and weight-groups seem to be represented in all periods. In the 9th century weights vary from 12 g to 56 and in the 10th from 5 g to 38. There is variation in diameter from 25 to 42 mm and in height from 7 to 29 mm (Tab. 13.9). The table displays a diverse assembly of spindle-whorls in material, shape and size. The collection is, however, too small to draw any conclusions about changes over the centuries and decades, while, as already noted, not all of the artefacts could be examined.[22] Compared with the spindle-whorls from the settlement area, there are more whorls of different types of mineral and fewer of clay.

The dating of the spindle-whorls from both the settlement areas and the graves clearly demonstrates the spinning of different qualities of yarn, and the presence of textile production from the earliest phase until the demise of Kaupang as an important urban settlement in the 10th century.

Period	ID	Type	Material	Weight (g)	Diameter (mm)	Height (mm)
800–850	Ka. 265	F	Red stone	56.8	42	19
	Ka. 268	F	Steatite	20.1	32	11
	Ka. 299	D	Jet?	-	38	14
800–900	Ka. 250	A	Steatite	-	35	-
	Ka. 306	F (?)	Sandstone	-	38	-
	Ka. 310	B	Steatite	12.8	25	13
850–900	Ka. 218	A	Fired clay	-	25	13
	Ka. 301	F	Steatite	-	34	18
850–950	Ka. 295	B	Steatite	38.3	41	17
	Ka. 295	A	Fired clay	c.20	37	-
	Ka. 303	E	Steatite	13	30	8
	Ka. 406	D	Fired clay	-	33	29
900–950	Ka. 3	F	Fired clay	21.3	32	14
	Ka. 16	A	Fired clay	-	34	13
	Ka. 284	E	Sandstone	5.2	22	7
	Ka. 321	G	Green stone		28	
900–1000	Ka. 10	B	Steatite	29.2	33	18
	Ka. 282	A	Serpentine?	-	40	12
	Ka. 282?	A	Bone	-	37	16
	Ka. 282?	F	Steatite	-	30	9
Undated	Ka. 154	A	Serpentine?	-	30	13
	K/1950e	F	Steatite	36.5	35	19
	K/ 1950f	G	Red stone	25.6	24	24
	K/1950g	A	Fired clay	23	42	16
	K/1950g	B	Fired clay	36	35	19
	K/1954k	C	Fired clay	-	32	19
	K/1954l	B	Stone	-	36	17

Table 13.9 *Datable spindle-whorls by type, material, weight and dimensions. N = 27.*

Site Period	Number of find-units	Percentage of all datable loomweights	Weight (kg)
SP I	28	10%	2.3
SP II	163	61%	16.2
SP III	7	3%	1.8
SP I–III	70	26%	8.2
All SP	268	100%	28.5

Table 13.10 *Loomweights from Kaupang MRE in relation to Site Period.*

13.3.2 Loomweights

Altogether 268 (43%) of the find-units representing loomweights from the 1998–2003 fieldwork can be assigned within SP I to SP III, showing that weaving was carried out in all periods. Both quantitatively and by weight, SP II stands out. A further 128 find-units were found in the later medieval plough-layer and in the modern ploughsoil (43 specimens). The remainder have no stratigraphical context (Fig. 13.27, Tab. 13.9).

Although the loomweights generally appear in a fragmented condition, they all seem to have more or less the same basic forms and size, as far as they can be measured, in all periods. Possible loomweights of schist occur in SP II and of sandstone in the medieval plough-layers. Loomweights of unfired clay are also recorded from SP II, when decorated loomweights also first appear, with stamp and comb impressions, circles and pairs of parallel lines. It is interesting to see that loomweights occur in the initial urban phase, SP I, interpreted as a period with only seasonal activity and lacking evidence of buildings. The finds of loomweights representing upright looms and weaving may, however, be seen as an indication of at least seasonal settlement, as the upright loom itself, and the weavers, require some kind of shelter. There are, however, some doubts as to whether the dating to SP I is correct in every part of the site (Pilø, this vol. Ch. 10:287; Pilø and Skre, this vol. Ch. 2:23–4).

Only one loomweight has been found in a grave (Ka. 283), where it is dated to 850–950. The stray finds of remains of two possible loomweights of clay cannot be dated. The iron weaving battens found in graves (cf. Tab. 13.8) are dated from the early 9th century to the 10th century generally. The dating of loomweights and weaving battens reveals the same pattern as the spindle-whorls – there was activity related to textile production throughout Kaupang's period as a town.

Five of the needles of both iron and copper alloy belong to SP II. All of these, however, are uncertain items of textile-production equipment. This is also the case with the one iron needle from SP III. The bone needles were all found in the plough-layers. Two needle-cases – a copper-alloy needle-case (Ka. 210: Blindheim et al. 1981:pl. 64) and a looped needle-case (Ka. 257) – can be dated to the first half of the 9th century and the 10th century respectively (Stylegar 2007:114–17).

Two of the smoothing stones are dated to SP II, the early 9th century, while the others were in disturbed layers. The possible smoothing stones in burials (Ka. 271 and 307) are both from the earlier 10th century, but are rather uncertainly identified.

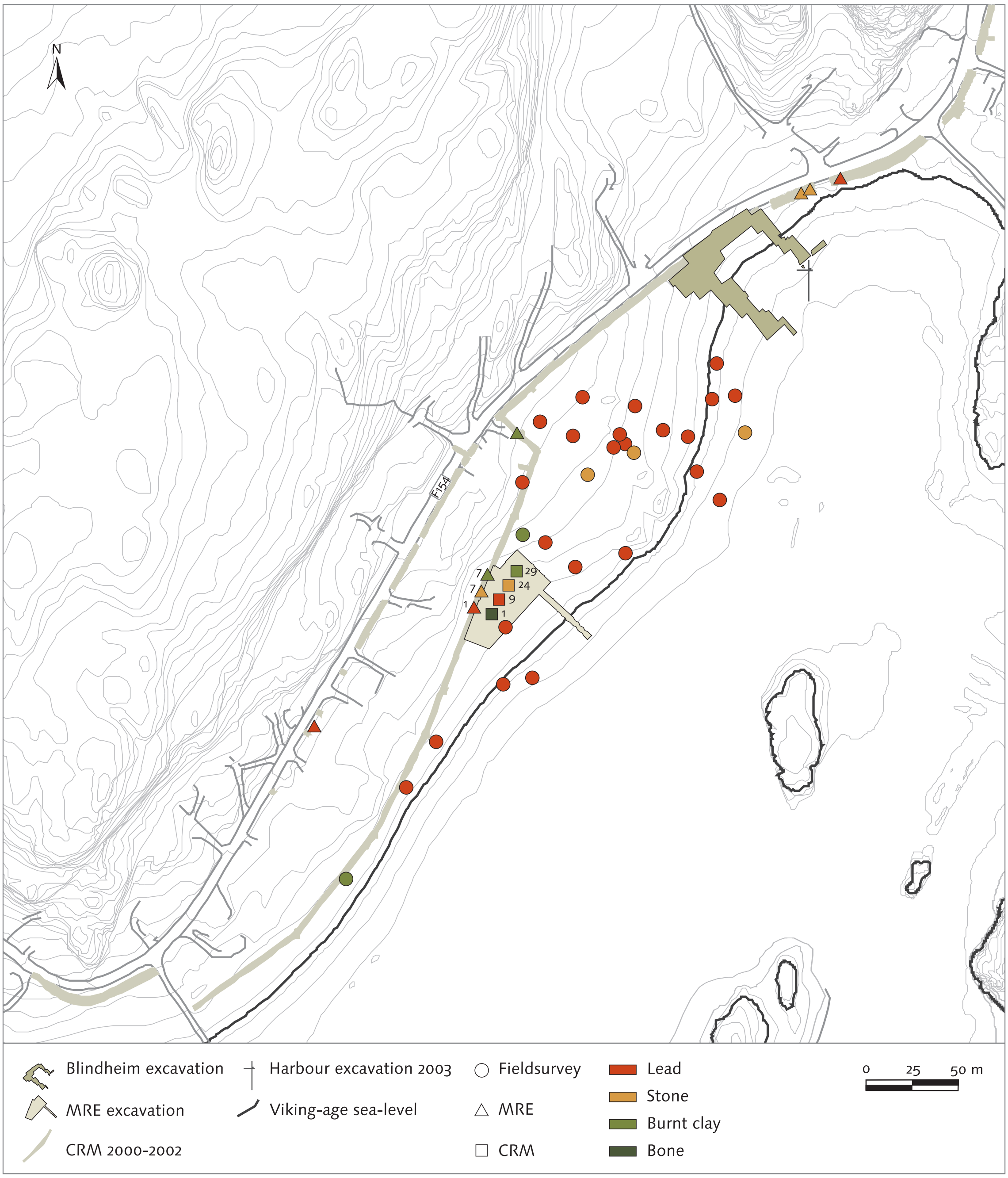
It is not possible to give a close dating for the shears found in the settlement areas. One pair is from the late-medieval plough-layer; the other has no stratified context. One of the pairs of shears from a grave is dated to the 9th century, the others to the first half of the 10th (cf. Tab. 13.8).

Altogether, the equipment for textile production related to Site Periods and datable burials shows that all types of implement that are represented at Kaupang were used from the early 9th to its latest phase in the mid-10th century. The fragmentary evidence and the limited number of complete objects makes it difficult to draw any decisive conclusions about development over time and it is impossible to trace significant chronological differences.

13.4 Spatial distribution

Spatial distribution may give us more precise information on where textile production was carried out, but it is also affected by how the fieldwork was carried out and the conditions for preservation. The artefacts from the fieldwork of 1998–2003 derive both from surface surveys in different parts of the settlement area and from the excavation of specific sites within it. The maps show the distribution of spindle-whorls (Fig. 13.28) and loomweights (Fig. 13.29) from both the Cultural Resource Management trench (CRM) excavated 2000–3 and the main research excavation area (MRE) of 2000–2, together

22 The dimensions of the spindle-whorls that were not available for inspection are based upon information in Blindheim et al. 1981 and 1995; their weights are not recorded. The identification of stone spindle-whorls other than of steatite is based on Blindheim's identifications, sometimes with a question mark.

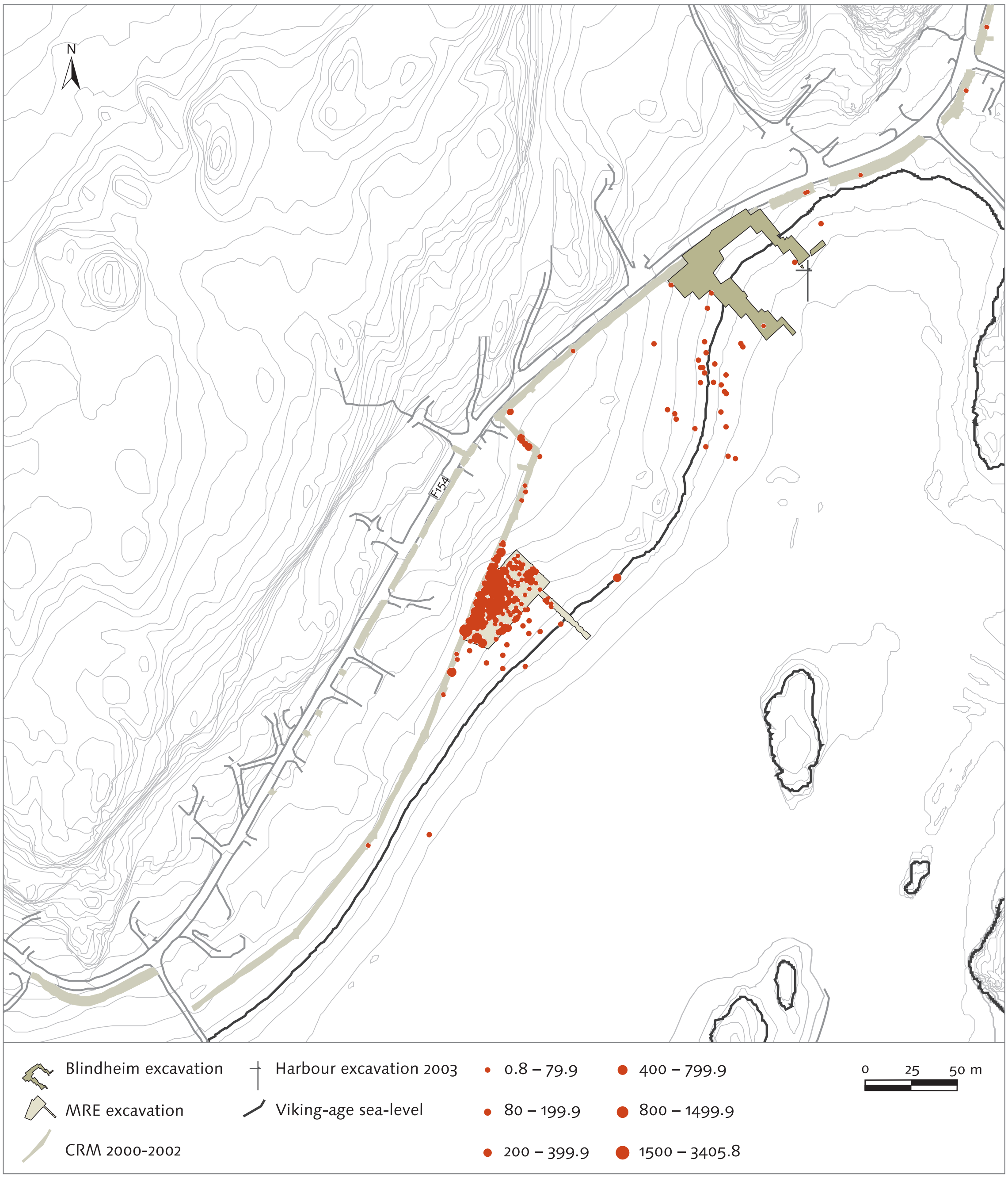


with the field survey. Most of the equipment for textile production was found in the MRE. As shown in Figure 13.28, the majority of the spindle-whorls of lead were found in the plough-layers during the field survey. This type is generally over-represented compared with whorls of other material as a result of the extensive use of metal detectors. Only two (7%) of a total of 27 lead whorls were located in undisturbed deposits in the MRE.

In Figure 13.29, loomweights have been plotted according to weight in the grid system of one-metre squares. This plan does not distinguish between finds in intact layers and in disturbed ploughsoil. The low number of artefacts from the ploughsoil in the south-eastern part of the settlement area is prob-

Figure 13.28 *Distribution of spindle-whorls (by nos.) from both field survey, the MRE and the Cultural Resource Management trench (CRM). Contour interval 1 m. Map, Per Bækken.*

Figure 13.29 *Distribution of loomweights (by weight) from both field survey, the MRE and the Cultural Resource Management Trench (CRM). Contour interval 1 m. Map, Per Bækken.*



ably because the only area accessible for field survey was the former beach between the sea and the higher lying zone of buildings plots. This zone is located under the lawns of the houses of the modern residential area. Consequently the area surveyed there cannot be compared directly with the central and northern settlement areas (pers. comm. D. Skre).

As outlined above, plot-division was best documented during the MRE, with three plots, 1A, 2A and 3A, fully excavated and three other plots further west, 1B, 2B and 3B, partially excavated. Two further plots, 4A and 4B, were visible to the north of plots 3A and 3B. It is therefore interesting to examine how the textile-production equipment is related to the plots and structures within this area (Figs. 13.30–31).

The only spindle-whorl from SP I (cf. Tab. 13.11) was recovered at plot 2A in layers representing outdoor activities or midden deposits. One of the unfinished whorls of steatite was found on the same plot in SP II, sub-phase 2. Two spindle-whorls of fired clay were also located on plot 2A, sub-phase 2, weighing c. 8 and 25 g respectively. Of the total of fifteen spindle-whorls related to SP II, seven – whole or part – were located on plot 1A, all of fired clay, originally representing different weight categories from 8 g to 36. One spindle-whorl of lead (38 g) was found on plot 3A, sub-phase 1, and two spindle-whorls of stone (weighing 7.1 and 12 g) on the same plot but from sub-phase 2. Altogether, there are clear traces of spinning on three of the plots: 1A, 2A and 3A.

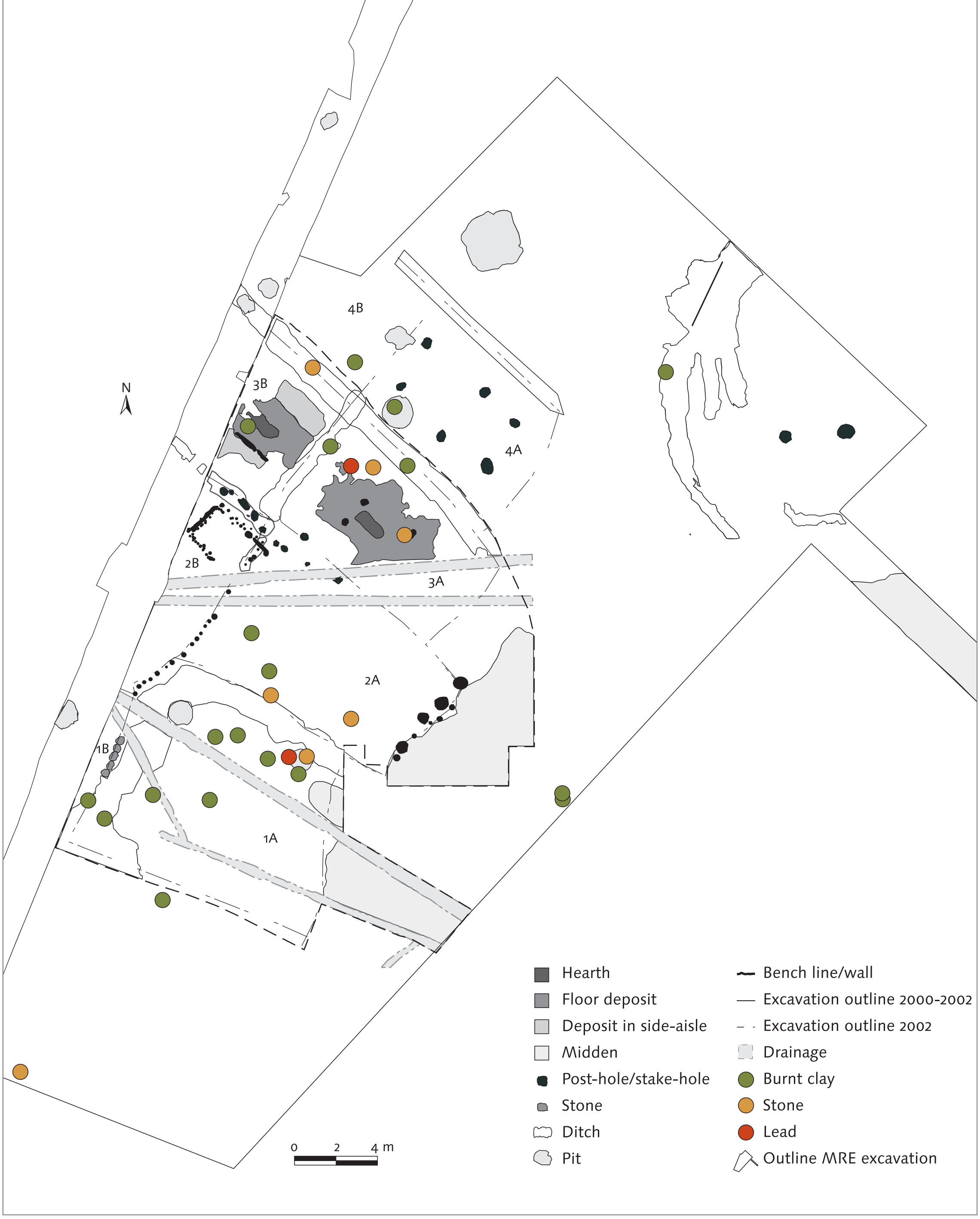


Figure 13.30 *Distribution of spindle-whorls (by nos.) in relation to the plots. Map, Per Bækken.*

Figure 13.31 *Distribution of loomweights (by weight) in relation to the plots. Map, Per Bækken.*

The three spindle-whorls from SP III (cf. Tab. 13.7) were also located on plot 1A. Six spindle-whorls of fired clay, all damaged, could only be assigned to SP I–III generally, without any connexion with plots or other structures.

Generally, the spindle-whorls within the plots seem to have been discarded, as only four were complete, two of which were poorly fired and one was not completely centred. The others were either broken or represented by fragments. In addition, a broken spindle-whorl of fired clay was found in the ditch between plots 3A and 3B, and in the ditch between plot 3 and 4 a small fragment of a spindle-whorl from the same sub-phase was found. It is therefore tempting to link the distribution of finds with activities connected to textile production within these plots – 1A, 2A, 2B, 3A, and probably also plot

4 – from the early 9th century onwards and at 1A, 2A and 3A representing both spinning and weaving (Figs. 13.30–31).

The majority of the loomweights found in stratified contexts are from SP II and SP III, as there were only a few finds from SP I (cf. Tab. 13.10): 29 find-units altogether, of which 28 are of loomweights of fired clay (2.4 kg), most of them in a rather fragmentary condition. Only four could be measured; these fall into the general pattern of loomweights of 9–11 cm in diameter, but with different heights, 2.5–3.1 cm, implying a difference in weight. Nearly all the finds of loomweights from SP I are from plot 2A, together with a small fragment on plot 1A and two on plot 2B. Plot 2A, however, was in a poor state of preservation and it was hard to distinguish the layers. Artefacts assigned to SP I may rather be related to SP II (see above, p. 361, and Pilø, this vol. Ch. 10:287, 303). Nevertheless, two further loomweights associated with SP I are recorded from the ditch between plots 2A and 2B (weight: 153 g). Altogether, the evidence may indicate textile production on two of the earliest settled plots, simultaneously implying some kind of structures to house such activities.

The distribution of finds from SP II shows increased activity related to textile work on several plots – 1A, 2B, 3A and B. The highest concentrations of loomweights are located in plots 1A and 3B; in plot 1A 30 find-units (2.4 kg): 27 of fired clay, one unfired and two of schist; in plot 3A 35 find-units (2.3 kg): 17 from sub-phase 1 and 18 from sub-phase 2. Fifteen find-units were found at plot 3B (2.1 kg), the highest concentration from sub-phase 1. Sixteen find-units of loomweights (810 g) were from plot 2A: twelve

Plot	SP I	SP II sub-phase 1	SP II sub-phase 2	SP III	SP I–III
1A	1 loomweight (7 g)[23]	7 spindle-whorls, 30 loomweights (2.4 kg)		3 spindle-whorls	
1B					
2A	1 spindle-whorl, 24 loomweights (2 kg)	12 loomweights (218 g)	1 unfinished whorl, 2 spindle-whorls, 4 loomweights (592 g)		4 loomweights (80 g)
2 B	2 loomweights (153 g)				
3A		1 spindle-whorl, 17 loomweights (1.3 kg)	2 spindle-whorls, 18 loomweights (1 kg)		1 loomweight (75 g)
3B		8 loomweights (1.9 kg)	7 loomweights (172 g)		
4A					
4B					11 loomweights (632 g)

Table 13.11 *Textile-production equipment from Kaupang MRE in relation to plot and Site Period.*

from sub-phase 1 and four from sub-phase 2. Ten find-units of loomweights come from plot 2B: six from sub-phase 1 (353 g) and four from sub-phase 2 (292.7 g).

More than seventy find-units of loomweights stem from the ditches between the plots: those between plots 2A and 2B, plots 2B and 3, plots 2A and 3A, plots 3A and 3B (928 g from these areas), and a particularly large assemblage between plots 3 and 4, a total of 29 find-units (4.9 kg). Eight were also found in the passage between plot 3A and 3B (743 g).

From SP I–III generally, 21 find-units could be related to plots: four on plot 2A (80 g), five on plot 2B, one on plot 3A (75 g), and eleven on plot 4B (632 g). Others are from the ditches between plots 3A and 3B and plots 3 and 4.

As shown in Figure 13.31, there is a significant concentration of loomweights in the northern part of plots 3A and 3B. These, however, have been found at the fringe of the site and in a ditch. There are relatively few finds from plot 2B, where a lot of refuse was found but no buildings. At building A200 on plot 1A, a few remnants of loomweights were recorded in the midden east of the building and in the layers of waste to the north and west (pers. comm., Lars Pilø 2006). To judge by the finds found sealed within the layers on the plots and in the ditches between them, weaving seems to have been carried out on nearly all the plots.

It is therefore interesting to examine their relationship to structures. From SP II sub-phase 1, plot 3B, fragments of loomweights and other household debris have been located in building A303, probably the earliest building to be raised on the plots. The building had a hearth and was surrounded by occupation deposits with a fragment of a loomweight. At the same plot in sub-phase 2, a complete loomweight and a large number of loomweight-fragments were found along the edges of the plot and in the boundary ditch to the north, in contexts contemporary with building A301. These are obviously broken objects that were cleared from the floor of the building and dumped outside. The abundance of loomweight-fragments around the edges of plot 3B suggests that textile production was taking place in building A301 in the early 9th century (cf. Skre, this vol. Ch. 15:411).

Several concentrations of loomweight-fragments that were found in the boundary ditches had probably also come from nearby buildings, indicating that weaving was one of the activities on several plots at Kaupang. Four of the concentrations of loomweights mentioned earlier (above, p. 352) are dated to SP II: C52519/18601, with fragments of two, possibly three, loomweights found on plot 2A in a layer representing several contexts that are difficult to clarify because of later disturbance. Two concentrations, C52519/22562 with at least three loomweights, and C52519/22968 with two or three loomweights, were both found in the boundary ditch between plots 3B and 4B. The only concentration of loomweights from SP III, C52519/24380 probably with four or more loomweights, is from the same ditch, but was found between plots 3A and 4A, in the same place as concentration C52519/16422 with five, possibly six loomweights, dated to SP I–III generally.

The one case, C52516/1444, where loomweights belonging to a whole loom may be represented by fragments of about 28 to 29 loomweights (1.95 kg),

23 The quantities of loomweights given represents find-units.

Town	Fired clay	Stone	Bone	Lead	Other	Number
Kaupang	33%	44%	1%	21%		169
Birka	33%	50%	15%	-	2	429
Hedeby	88%	4%	6%	-	2	939

Table 13.12 *The materials used for spindle-whorls at Kaupang, Birka and Hedeby by percentages.*

was recorded during the CRM excavations, probably from a single, intact context which should most probably be assigned to SP II (pers. comm., Lars Pilø 2007).

According to Pilø (2007d:213), "Hus III" from Blindheim's settlement excavations, with a large number of unfired loomweights found in situ inside the lower stone wall in the structure (Tollnes 1998:43), can also be assigned to SP II. Some of the weights were unperforated, and were not finished when the structure was demolished, testifying to the local production of loomweights in clay within Kaupang. According to Tollnes these were made using local clay (1998:43).

Altogether, the clusters of loomweights and their concentration in certain areas of plots 1A, 2A and B, and 3A and B obviously represent upright looms from adjacent buildings. Sometimes they are represented by cracked and damaged weights thrown out as rubbish, but in other cases plausibly by the evidence of weights that had been used on the spot. The damaged smoothing stones were found on plot 4B and plots 4/5, areas with little other equipment for textile production.

The extensive evidence of textile-production equipment over large areas both in the MRE and the CRM excavations as well as from Blindheim's earlier settlement excavations demonstrates the importance of textile production at Kaupang (cf. Skre, this vol. Ch. 15:412). This is also clear when the graves are taken into account, as one-third of the recorded graves contained textile-working implements.

13.5 Comparative perspectives

13.5.1 Viking-age towns – Birka and Hedeby

A comparison of the textile-production equipment at Kaupang with the finds from Birka and Hedeby shows both differences and similarities. Only a small part of the Kaupang settlement area has been excavated, a smaller scale of investigation than Hedeby but similar in size to Birka. The Kaupang finds also represent a shorter period of time than the two centuries or so of Birka and around 250 years at Hedeby. Consequently it is not surprising that the quantity of finds at Kaupang is much lower. The conditions for the preservation of finds are different too, with more favourable conditions for organic material at Birka and Hedeby than at Kaupang. The range of material is smaller at Kaupang as a result, as only few items of wood and bone have survived amongst the equipment for textile production.

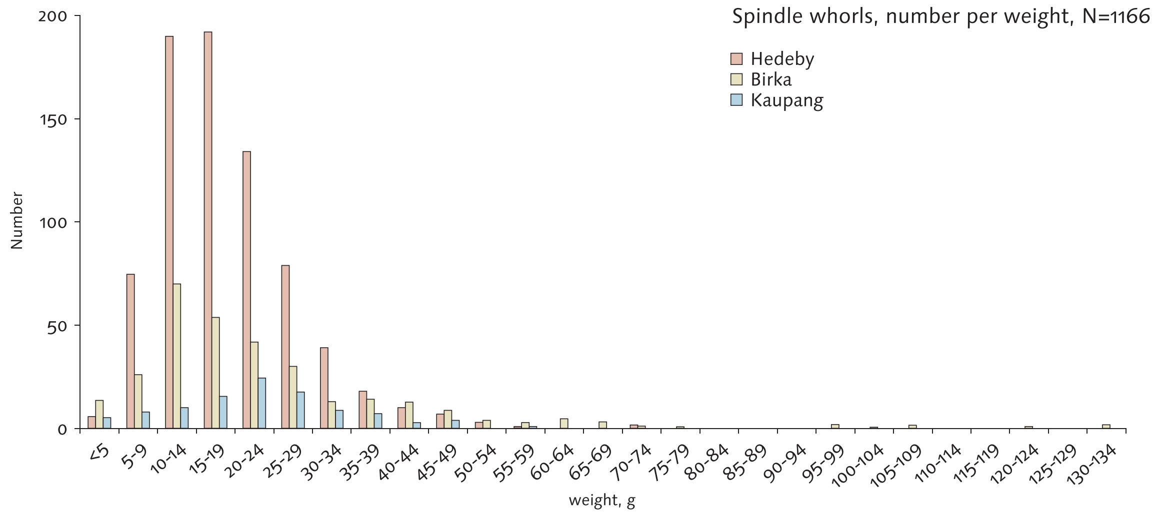
Spindle-whorls

In respect of spinning, the whole Kaupang material comprises a minimum of 176 spindle-whorls. This is 41% of the number of the spindle-whorls found at Birka (429) and only 19% of the total found at Hedeby (939). While differences in material and shapes may represent different cultural traditions, the size and weight both of spindle-whorls and of loomweights are primarily indicative of their function.

The materials from which the spindle-whorls were made produce different profiles in the three Viking towns. These reflect both cultural and functional differences. In this respect (Tab. 13.12), the Kaupang whorls are more similar to Birka than to Hedeby, where fired clay is the absolutely predominant material (88%). The proportion of whorls of fired clay at Kaupang and Birka is the same, at 33%. At Birka, spindle-whorls of stone are a little more common than at Kaupang: half of all the whorls compared with 44% of the Kaupang corpus, and only a small percentage at Hedeby. Bone whorls are also considerably more frequent at Birka at 15% compared with 1% at Kaupang and 6% in Hedeby. This difference can be explained by the conditions of preservation. The high quantity of lead whorls at Kaupang, 21%, is quite atypical as these are found neither at Birka nor Hedeby, while they are known from Viking-period graves in Norway (Petersen 1951:305) and later medieval urban contexts (cf. Øye 1988). The large number of lead whorls at Kaupang is also to be explained by the extensive use of metal-detecting during the 1998–2003 fieldwork. If the lead examples from the plough-layers are discounted, the proportions of stone and fired clay spindle-whorls at Kaupang will change accordingly.

The types that are recorded from Kaupang are also represented in the Birka and Hedeby material, while, like at Kaupang, there is a congruency between the shape and the material used.

In Hedeby conical forms generally dominate the clay whorls, and flat forms the stone whorls. In Birka only 16% are conical (C), a lower frequency than at Kaupang as a whole (26%) where there are many conical lead whorls (cf. Tabs. 13.1 and 13.5).



Hemispherical forms (A and B) are the most common shapes at Birka (32%), nearly the same percentage as at Kaupang (38%). However flat forms (E and F) are more common at Kaupang (32%) than Birka (18%). At Birka 9% of the whorls are biconical (G), or irregular in form (3%). At Kaupang the biconical shape is less frequent, at only 4%. The spindle-whorls from Kaupang thus seem to stand in an intermediate position between Birka and Hedeby in terms of shape and material.

The range of weights is interesting for measuring the degree of specialization. At all three sites, the spectrum is quite wide, and widest at Birka, where the weights vary from less than 5 g to 89 g and with a few whorls weighing more than 100 g. In Hedeby the spindle-whorls vary from 4 g to 75. At Kaupang the spindle-whorls vary from less than 5 g to 59. At Birka, spindle-whorls between 5 and 29 g are the most common, with a peak from 10 to 14 g. At Hedeby, spindle-whorls between 10 and 25 g are the most common, with the peak between 10 and 20 g. (Andersson 2003:118–19). At Kaupang spindle-whorls weighing 15 to 29 g are the most common, with a peak from 20 to 24 g (Fig. 13.32).

A comparison of the range of weights of spindle-whorls (Fig. 13.33) shows that in spite of the differences in the material used, they concentrate in more or less the same weight-groups. The spindle-whorls from Birka and Hedeby include a wider range of heavy whorls, weighing up to more than 100 g. At Kaupang only two whorls weigh more than 60 g, at 90 and 200 g respectively. Kaupang also has a higher proportion of spindle-whorls in the weight-group of 25–35 g than Birka or Hedeby (Andersson 2003:142), the latter showing a pattern more closely parallel to Kaupang. The variation in weight thus indicates a corresponding range of thread quality, from the thinnest and finest threads to coarser yarn in all three towns. Compared with Birka and Hedeby, the Kaupang spindle-whorls have a greater concentration of medium heavy whorls, suitable for spinning woollen yarn of medium/thin quality. In fact, though, any quality could be produced.

Loomweights

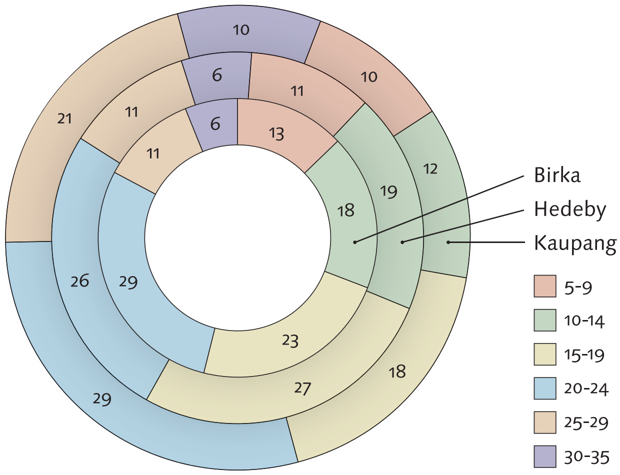
Eva Andersson, who has analysed all the textile-production equipment from Birka and Hedeby, notes a total of 649 find-units of loomweights that have been recorded from Birka, comprising approximately 1,400 fragments, of which 70 objects could be weighed. These vary from 200 g to 1.9 kg, with a concentration between 400 and 800 g. Only a very small number (14) could actually be measured, varying between 8 and 18 cm in diameter, with a concentration around 11–14 cm (Andersson 2003:82 and 93–4). The Hedeby loomweights form a much larger assemblage, comprising more than 4,000 fragments, of which about 580 can be measured, varying from 50 g to 1.9 kg but with a clear concentration between 300 and 600 g. The diameter ranges between 6 and 17 cm, with a concentration around 9–12 cm, and their thickness ranges from 2 to 8 cm, with 3–4 cm as the norm (Andersson 2003:121).

Compared with Birka and Hedeby, then, the Kaupang material is much more fragmentary, probably due to different methods of excavation and recording. It comprises about 2,700 fragments but few that can provide the weight or dimensions of a loomweight. The loomweights whose weights can be estimated vary between 150 and 800 g, but normally between 200 and 500 g, which is rather light compared with the loomweights found in the other two Viking-period towns.

At all three sites nearly all of the loomweights are fired clay. Decorated or marked loomweights are less common at Kaupang than at Birka or Hedeby, but the same types of impression were used. While only 7% of the find-units representing loomweights from Kaupang had some kind of mark, 12% of the Birka weights are decorated with small circles, key impres-

Figure 13.32 *All recorded spindle-whorls from Birka, Hedeby and Kaupang by weight. (cf. Andersson 2003:141).*

Figure 13.33 *The distribution by weight-group of spindle-whorls from Birka, Hedeby and Kaupang in 5 g intervals from <5 g to 35 g as percentages of total number (cf. Andersson 2003:142).*



sions, pits, cruciform impressions, stamps or comb impressions, but no decoration could be associated with any particular size of loomweight (Andersson 2003:82). Altogether 30% of the material from Hedeby is decorated. The most common decoration consists of large pitted impressions. Impressions of combs, sticks, tubular bones, various stamps and keys also occur. It is above all loomweights weighing 300–600 g that are decorated, but no specific decoration can be associated with a particular size as a rule, and marking was probably not used to mark a specific standardized weight although it could have served other purposes, such as to mark weights for a particular weave or as a brand to mark the weights of specific producers (Andersson 2003:124). Such may also be the case at Kaupang.

Altogether, the loomweights from Kaupang appear to be very much of the same shape, size and material as those from the other Scandinavian urban communities of the Viking Period but with a more limited range of weight-groups, nonetheless broad enough to produce different types of fabrics and qualities. As at Kaupang, loomweights in graves are rare at Hedeby, and none have been found in such contexts in Birka.

Andersson (2000, 2003) has also compared the Birka material with textile-production equipment in early urban sites in Skåne and with contemporary finds from rural contexts. She found that the equipment for textile production from the urban sites differs from the finds in the hinterland, being more varied and indicative of more specialized textile production. I shall consider this observation in relation to Kaupang.

13.5.2 Textile-production equipment from rural contexts

When comparing the Kaupang material with other Norwegian finds from the same period, distinct geographical patterns emerge, indicating differences between the west and east of the country. There are many finds in Hordaland and Sogn og Fjordane. When Jan Petersen (1951:302–11) published his survey of Viking-age equipment from Norway, he listed 450 spindle-whorls, a two-thirds majority of stone, with shapes that can be compared with the types found at Kaupang: particularly types A, B and G. Spindle-whorls of fired clay constituted 22% of the corpus but had a distinct geographical distribution, being most common in the coastal areas of the eastern part of the country and in Trøndelag. 14% of all spindle-whorls were from Vestfold. These had a rather different profile from the rest of the country, except Nord-Trøndelag, with a higher proportion of fired clay, 38%, compared with 29% of steatite, 32% of other minerals and, interestingly enough, 2% of lead. It is interesting to observe that the proportion of fired clay is generally higher, and at about the same relative level as at Kaupang. Conical and biconical whorls of fired clay were also found only in Vestfold (Petersen 1951:302–5) – forms that are also known from Kaupang. Petersen does not, however, give any detailed information about size or weight – only that the diameter varies from 2 to 5.2 cm, with the most common size between 3 and 4 cm (Petersen 1951:310). This is generally larger than the whorls found at Kaupang (cf. Fig. 13.7). The spindle-whorls from rural contexts thus seem generally to be larger and heavier than those from Kaupang. The same tendency also appears from a comparison with the spindle-whorls from Viking-period graves in western Norway (Øye 1988:52 and 131). Andersson's analysis of the equipment at Birka and in its hinterland reveals a similar situation – the tools from rural contexts are less diverse (Andersson 2003:135–6).

Petersen's national survey of 1951 also refers to 82 find-contexts with a total of 449 loomweights, reflecting differences in burial practice with only a very few burials containing loomweights from the eastern part of the country (Petersen 1951:296–300), with which the Kaupang burials concur. The loomweights, however, are generally made of stone, often oval or pear-shaped. Only 24 circular weights of fired clay are recorded, six of them from Vestfold (Petersen 1951:298). Most of these are 8–10 cm in diameter and 2.2–3 cm thick – more or less the same sizes that occur at Kaupang (cf. Figs. 13.18–19).

The textile-production equipment from Huseby in Tjølling is also of interest in the context of Kaupang, but too sparse to make a comparison as only three spindle-whorls and about 70 fragments of loomweights have been recorded (Skre 2007e:238, figs. 11.14–15). These nevertheless are of the same forms and material as at Kaupang: fired clay for the loomweights and steatite, fired clay and lead for the spindle-whorls.

Although fired clay seems to be more common in the Vestfold region than in other parts of Norway, it is interesting to observe that Kaupang shows an even stronger predilection for fired clay than for stone, just like the other urban settlements of the Viking Period but different from the looms and steatite loomweights of the medieval towns of Norway, apart from Oslo (Rui 1991; Øye 2010).

13.5.3 The character of textile production at Kaupang

The details of the equipment for textile production, both the spindle-whorls and the loomweights, shows that textile production at Kaupang was extensive and varied, not least in light of the small area that was excavated and the relative short time-span represented, about 150 years. The textile-production equipment could have produced many different types of textile, from the most exclusive fabrics to coarser ones. The weight-ranges of both the spindle-whorls and the loomweights indicate that the quality of the yarn and fabrics produced at Kaupang could have been of about the same qualities as produced in Hedeby and perhaps also at Birka, qualities that were typical of the Viking Period, and also that it was possible to make cloth of both finer and coarser fabric – and high and low thread counts. Generally, the equipment seems to have been more varied than that found in rural contexts. The diversity and quantity both of spindle-whorls and loomweights and their chronological and spatial distribution indicate activities beyond the household level. As in Birka and Hedeby, the finds signify relatively specialized production. Despite this, Anne Stine Ingstad (1999:266) considers it likely that most of the finer textiles recorded in graves at Kaupang were imported, suggesting a western, Insular origin. Blindheim, however, has suggested that Kaupang could have been a centre of textile production on the evidence of the finds of equipment for textile production (referred to in Ingstad 1999:227).

The textiles found at Kaupang, all from the graves, are of various qualities. Of the 143 identified fragments out of a total of 196, the majority are wool, although linen is represented. Ingstad has classified the material into four categories – coarse, medium, fine, and very fine – woven as tabby (39 fragments), 2/2 twill (77 fragments) of two types with Z/S-spun and Z/Z-spun yarn respectively, lozenge twill (26 fragments) and chevron twill (8 fragments), many of them of excellent quality. The majority of the 2/2 twills from Kaupang have Z/Z-spinning. Because of its geographical distribution, this type of twill has been called a "Norwegian type" (Ingstad 1999:266–7). In principle, all of the textile found at Kaupang could have been produced using the implements found at the site. Eva Andersson has come to a similar conclusion with regard to the Birka textiles (2003:53 and 99), which are generally finer and more exclusive than their counterparts from Kaupang.

13.6 Women at Kaupang

If the spinning and weaving equipment represents a mainly female occupation, the finds concurrently shed light upon the demographic structure of Kaupang. A strong female representation is also shown in the cemeteries. Of the datable burials that are identified by gender, female graves (= 41 datable female graves) comprise 58% (22 of 38) of the gendered graves in the 9th century and 24% (12 of 50) in the 10th – a far higher female representation than in the region as a whole, where the figure is 25% (Stylegar 2007:65 and 82). As Stylegar has pointed out, there are several crucial methodological problems relating to the gender-identification of burials, which is based on gender-specific objects, especially weapons and dress-accessories/jewellery (Stylegar 2007:65). It must also be noted that the sex ratio in graves cannot be taken as a direct reflection of the underlying population but rather of the social and economic circumstances. This is obvious in the fact that the sex ratio in Viking-period graves in rural contexts in Norway is normally 20:80 – a ratio that has been connected with property rights (Øye 2005:82 and refs.). There is nevertheless a striking difference at Kaupang from the gender pattern of burials in rural areas which may signify a difference in gender roles in urban and rural contexts. A surprisingly high ratio of female graves is also documented at both Birka and Hedeby. In Birka 58% of the inhumations were female and 61% of the cremations (Gräslund 1981:82), while a study of a sample of skeletons from Hedeby also gives a high number of females, 38% (Randsborg 1980). Taking the large amount of textile-production equipment both in the settlement areas and in the graves into account, a possible explanation could be the women's role in textile production.

Demand for textiles of widely varying qualities must have been high in the new urban socie-

Textile tool	Female	Male	Double?	Uncertain gender
Spindle-whorls	Ka. 3, 10, 16, 22, 265, 268, 284 (2), 285, 299, 303, 310, 406	Ka. 282 (3), 295 (2), 301, 321	Ka. 250	Ka. 154, 218, 306
Weaving batten	Ka. 10, 14, 16, 22, 253, 294, 296	Ka. 255 (?). 302 (?)		
Shears	Ka. 16, 250, 285	Ka. 6 (2?),11, 204, 252, 257 (2?), 302	Ka. 250	Ka. 166
Needle-case	Ka. 210	Ka. 257		
Smoothing stone		Ka. 270, 307		
Loomweight	Ka. 283			

Table 13.13 *Graves with textile-production equipment from Kaupang by gender. N=37.*

ties, both for prestigious and for utility products, including sails. The population at Kaupang has been estimated at around 500 in its heyday (Stylegar 2007:65). It is reasonable to infer that many of these were women involved in textile production, both directly and indirectly, and probably not only for the townspeople's own needs. The time-consuming processes of spinning and weaving must have required many hands and extensive supplies of raw material. Experiments have shown that to produce ten Viking-period garments about 30 kg wool was needed. With 1–2 kg of usable wool being produced per sheep, (Andersson 2003:47) wool from a great number of sheep was needed in the textile production on a larger scale. Thus the importation of wool, flax and possibly hemp from the surrounding countryside was necessary. This involved networks and an organization for distribution and storage, economic transactions in which women may have taken part.

Since Antiquity, time-consuming and labour-intensive, large-scale spinning and weaving have traditionally been performed by women of low rank – and many hands were needed to get enough yarn. The women who organised and administered the work could, however, have a high status. Contemporary written sources from the Continent describe textile production as a female industry, administered by elite women at one end of the hierarchy with women of lower rank, even unfree individuals, at the other end (Herlihy 1990:36–7). It is therefore tempting to associate textile production at Kaupang with women of lower rank, while women who were given spectacular burials in mounds and boats may have belonged to the opposite end of the social spectrum. Work was largely carried out within gendered hierarchies and workplaces at that time. Large-scale textile production needed a considerable level of administration, supervision and a special competency in assessing the quality of the products. That cloth was used as a standard of value presupposes a certain degree of specialization and control, as expressed in later Icelandic laws. Traditionally, husbandry and gardening that supplied raw materials for textile production also belonged to the female sphere. It may well be the case therefore that the administration and economy concerned with textile production fell under female control.

It is interesting, as a result, to see the frequent inclusion of equipment for textile production in female graves at all three Viking towns. The use of textile-production equipment as a general symbol of textile production and a female activity may perhaps also explain the relatively high proportion of women in the cemeteries at Kaupang. As we have seen, 37 of the burials at the cemeteries around Kaupang, located at the cemeteries at Bikjholberget and Nordre Kaupang, contained such implements. The majority that could be attributed to a gender were female, and some of these were prestigious burials with women buried in long barrows, all of them at the cemetery of Nordre Kaupang and all containing textile-production equipment (Ka. 3, 10, 14, 16 and 22), namely spindle-whorls and a weaving batten (Stylegar 2007:87 and 155). There are, however, also several male burials with such implements, including three uncertain identifications of textile-production equipment in one double grave, and three of uncertain gender (Tab. 13.13) – as some of these seem to have been moved and disturbed (e.g. Ka. 282 and 306).

Although more of these burials may be female, the gender distinction is not quite clear cut. While spindle-whorls occur most often in women's graves, they have also been found in male contexts, but only 6% of the whorls have appeared in such contexts in Norway as a whole (Petersen 1951:308). In Kaupang eight of the 27 spindle-whorls from the graves seem to be recorded in four male burials, although some uncertainty is connected to the context of two of the spindle-whorls (Ka. 282). The spindle-whorls in male contexts do not, however, stand out from the other spindle-whorls. With diameters around 30–40 mm, heights from 9 to 17 mm and weights from 20 to 38 g, they represent whorls used to spin medium/thick to thicker threads but not the finest.

Generally, spindle-whorls and weaving battens are the most frequent artefacts amongst the textile-production equipment in the graves. At Kaupang all positively identified weaving battens are from female graves, and the only loomweight in a grave context is also from a female burial. Loomweights and weaving battens have, however, also been found in men's graves, especially in western Norway, where some of the battens are of the heavier types (Petersen 1951:296–8). Shears are more often found in male burials than female. This probably implies that men could be engaged in textile production. It has been suggested that they might be involved in the heavier production of sails, because such finds are frequent in the principal wool-production districts (Rabben 2002). There are, however, no clear qualitative distinctions between the tools in male and female graves at Kaupang and the iron weaving battens that have been mentioned in connexion with men and sailmaking that are found primarily in female burials at Kaupang. The grave finds show, however, that we should be cautious in drawing lines between gender-related artefacts too sharply.

The finds of equipment for textile production indicate – as at Birka and Hedeby – textile production on a larger scale and at a more specialized level than for purely domestic consumption, and that women were active in textile production during the whole period from the early 9th century until the middle of the 10th century. The diversity, quantity and range of equipment indirectly testifies to an urban society in which women played a specialized and major role in an important and time-consuming, but often underestimated, productive activity. Judging by the grave goods, women buried at Kaupang seem also to have held a special position and competence related to this early urban textile production.

Whetstones, Grindstones, Touchstones and Smoothers

14

HEID GJØSTEIN RESI

From the archaeological work at Kaupang of 1998–2003 have come fragments and the worn-out remains of whetstones, grindstones, possible touchstones, and smoothers. Altogether these number 1,822 objects, with a total weight of 56.7 kg.

The possible sources of the materials are discussed, and in what form they were brought to Kaupang. Topics concerning the shaping of the tools and the marks of wear on them are also discussed, together with questions of dating and association with possible activity zones, as well as the character of the finds from Kaupang compared with the sharpening tools from similar archaeological sites.

The geologist Helge Askvik concludes that 55% of the material by object count is dark grey, very fine-grained, lineated muscovite-quartz schist (referred to more simply here as dark grey schist) and 14% light grey, fine-grained, lineated muscovite-quartz schist (known as Eidsborg schist, referred to more simply here as light grey schist) while the remaining finds comprise about ten different types of stone. According to Askvik the dark grey schist was most probably taken from various quarries in the Caledonian belt in western Scandinavia, which runs from Rogaland to Finnmark in Norway. The light grey schist seems to be from the bedrock of southern Norway.

The occurrence of large blanks of dark grey schist in particular, although also of light grey schist, imply that this was the form in which the material was originally supplied and that the blanks were divided and the whetstones shaped in the settlement. Regular square or oblong rectangular cross-sections predominate amongst the bar-like whetstones. Oval or round cross-sections, which were so common on the quartzite whetstones of the Early Iron Age, do still appear but are quite rare. Whetstones of all types of material have been subjected to severe wear in the centre. This wear has often caused them to break, but the whetstone-fragments are often re-shaped so that they could continue to be used for as long as possible. This can be seen as evidence of the quality and worth of the material.

The distribution of the bar-shaped whetstones in datable contexts shows that the dark grey schist whetstones had a limited but conspicuous area of use as early as SP I on Plots 1A and 2A. In SP II diffusion to all plots except for 4A and 4B can be documented.

Schist whetstones are amongst the artefacts that were demonstrably exported from the area of Norway in the Viking Period. Paradoxically, the closest parallels to the assemblage of whetstones, grindstones and possible touchstones at Kaupang are at distant trading sites such as Hedeby, Dorestad and York.

The archaeological excavations at Kaupang of 1998–2003 yielded a total of 1,822 stone sharpening tools with a total weight of 56.7 kg (Fig. 14.1). This assemblage consists overwhelmingly of fragments of bar-shaped whetstones and of grindstones of various shapes. There is also a small number of unusual implements such as a rotary grindstone, possible touchstones for precious metals or pendants, and smoothers (Fig. 14.2).

Included in the figures cited are possible blanks of sharpening tools, identified on the basis of appropriate form and type of stone but with no traces of smoothing on any surface. In many cases these will very likely be broken and split pieces of whetstone, although definite blanks are also present. In this chapter, *whetstone* is the designation for a hand-held sharpening tool, while *grindstone* is a general term for both *rotary grindstones* which rotate around their own centre and *grindstones* which are fixed for use.

Material group	Quantity N = 691	Weight 46,973.4 g	Mean weight
Dark grey, very fine-grained schist	451	7,354.5 g	16.3 g
Light grey, fine-grained schist	80	3,161.7 g	39.5 g
Other types of rock	160	36,457.2 g	227.8 g

Material group	Quantity N = 1,131	Weight 9,733.6 g	Mean weight
Dark grey, very fine grained schist	566	4,350.3 g	7.6 g
Light grey, fine-grained schist	177	3,111.0 g	17.5 g
Other types of rock	388	2,272.3 g	5.8 g

Material group	Quantity N = 1,822	Weight 56,707.0 g	Mean weight
Dark grey, very fine-grained schist	1017	11,704.8 g	11.5 g
Light grey, fine-grained schist	257	6,272.7 g	24.4 g
Other types of rock	548	38,729.5 g	70.6 g

Figure 14.1 *Whetstones and grindstones classified by raw material, quantity and weight. a: Quantity of finds geologically classified by Helge Askvik; b: remaining finds grouped into the three classes of raw material by the present author; c: synthesis of (a) and (b).*

Figure 14.2 *Whetstones and grindstones classified by raw material and typological characteristics.*

As utterly essential equipment for maintaining sharp-edged iron tools, whetstones and grindstones are a prominent feature of the finds inventory of Viking-period settlements. They are also included as grave goods. Normally, the material of the whetstones was carefully selected amongst the types of rock that offered a small, hard mineral grain which would serve as an abrasive during whetting. Earlier studies have indicated that Norwegian material for whetstones was sought after in many parts of northern Europe in the Viking Age and High Middle Ages (Falck-Muus 1921, 1957; Ellis 1969; Myrvoll 1985). Whetstones and grindstones found during the excavations at Kaupang of 1998–2003 may, together with finds from earlier work on the settlement site and in the cemeteries around the trading site, provide information on a narrow but important issue. Which raw materials were selected and where were they sourced? And what distinguishes the finds from Kaupang from the sharpening tools at comparable archaeological sites?

14.1 Petrological identification and geological classification

Macroscopic identification has been undertaken of 82% of the assemblage by weight (38% by find count) by Helge Askvik of the Institute of Geosciences at the University of Bergen. The set of finds classified in this way consists primarily of larger objects and only to a minor extent of small, sieved fragments. Askvik has also identified the whetstones found at Hedeby and in Charlotte Blindheim's work at Kaupang (Askvik 1990, 2008).

The collection of finds from the new excavations at Kaupang is dominated, like the others just noted, by two types of schist, and the remainder comprises a number of different types of stone. The larger group of schist, accounting for 55% of the assemblage by find count, is described by Askvik as "dark grey, very fine-grained, muscovite schist with prominent mineral lineation" (2008:7); this is referred to

	Object							
	Whetstones			Polishing blocks	Rotary gridstones	Miscellanious	Raw material	Quantity
Rock type	Fylly preserved	End part preserved	Midsection preserved			smoothing stones, uncertain whetstones		
Dark grey, very fine-grained schist	32	137	483				365	1017
Light grey, fine-grained schist	13	40	120				84	257
Other types of rock	8	13	24	78	1	5	419	548
Total	53	190	624	78	1	5	868	1822

more simply here as *dark grey schist*. A similar fine-grained type of stone is noted from many northern European settlements of the Viking Period and into the succeeding Middle Ages under slightly varying terminology (cf. Askvik 2008:7) as "muscovite-biotite-quartz-phyllite" (Ellis 1969), "blue phyllite" (Moore 1978), "dark blue-purple phyllite" (Moore 1983; Gaunt in Mainman and Rogers 2000:2484–5), "purple phyllite" (Crosby and Mitchell 1987) and "bluish-grey to dark grey phyllite" (Kars 1983). There are varying opinions as to its provenance (Hald 1991; Bautsch 1995). Variations in shade are also typical of the new finds from Kaupang, where, amongst other things, a clear "lighter variant" is characteristic of some 10% of the dark grey schist whetstones. On the basis of radiometric datings using the potassium-argon method and the distribution of finds relative to the relevant Caledonian belt in Scandinavia – which runs from Rogaland to Finnmark in Norway – Askvik concludes that the material of the whetstones at Kaupang in dark grey schist is from various quarries within this region (Mitchell et al. 1984; Askvik 1990, 2008).

The second type of schist, which accounts for 14% of the number of items found at Kaupang, is described as "light-grey, fine-grained, muscovite-quartz schist with prominent mineral lineation" (Askvik 2008:5), referred to more simply here as *light grey schist*. This is often called Eidsborg schist. R. Falck-Muus (1921, 1957) and S. E. Ellis (1969) linked this stone to the whetstone quarries at Eidsborg in Telemark which had been in operation from the Viking Age until 1950. The provenance of this stone is connected to the age of origin of between 900 and 950 million years that dominates the bedrock of much of southern Norway (Mitchell et al. 1984; Askvik 1990, 2008).

In various parts of Norway, a combination of two types of whetstone appears in Viking-period graves, usually one more coarsely grained suitable for preliminary sharpening and one fine-grained for the finishing touch (Petersen 1951:257; Resi 1987a:98–9, fig. 3). Three graves from Kaupang included a set of one light and one dark grey schist whetstone (Resi 2008:51). Experimental use of the original Viking-period whetstones from Hedeby has shown that these two forms of schist had different functional qualities (Resi 1990:49–51, Abb. 26). A light grey schist whetstone ground an iron blade down considerably and itself lost a considerable amount of its weight in the process. Whetting with a dark grey schist whetstone produced an evenly smooth polished surface and edge on an iron blade and the whetstone lost little weight. In daily life and production there was equal demand for both types of whetstone but the light grey types were especially subject to wear. Whetstones and grindstones of, for instance, coarse-grained sandstone may have fulfilled the same function to a degree.

In the case of whetstones from Eidsborg in more recent times, a distinction has been drawn between two qualities: "hardstone" and "softstone". The softstones may contain more calcite and are considered locally to be the best whetstones (Askvik 2008:7). The assemblage from Viking-period Kaupang includes light grey schist whetstones of both qualities.

The finds of other types of stone analysed by Askvik include the following: sandstone (in the form of grindstones, a rotary grindstone, and blanks), basalt and diabase (in the form of grindstones and unclassified fragments), microsyenite (in the form of whetstones, grindstones, smoothers and blanks), greenschist (in the form of whetstones, odds and ends, and unworked blanks) and various other sorts of schist including amphibolites (in the form of whetstones, grindstones and unworked blanks), quartzite (a whetstone), and highly calcitic mudstone/schist (touchstones). The probably local provenance of these types of stone is discussed in

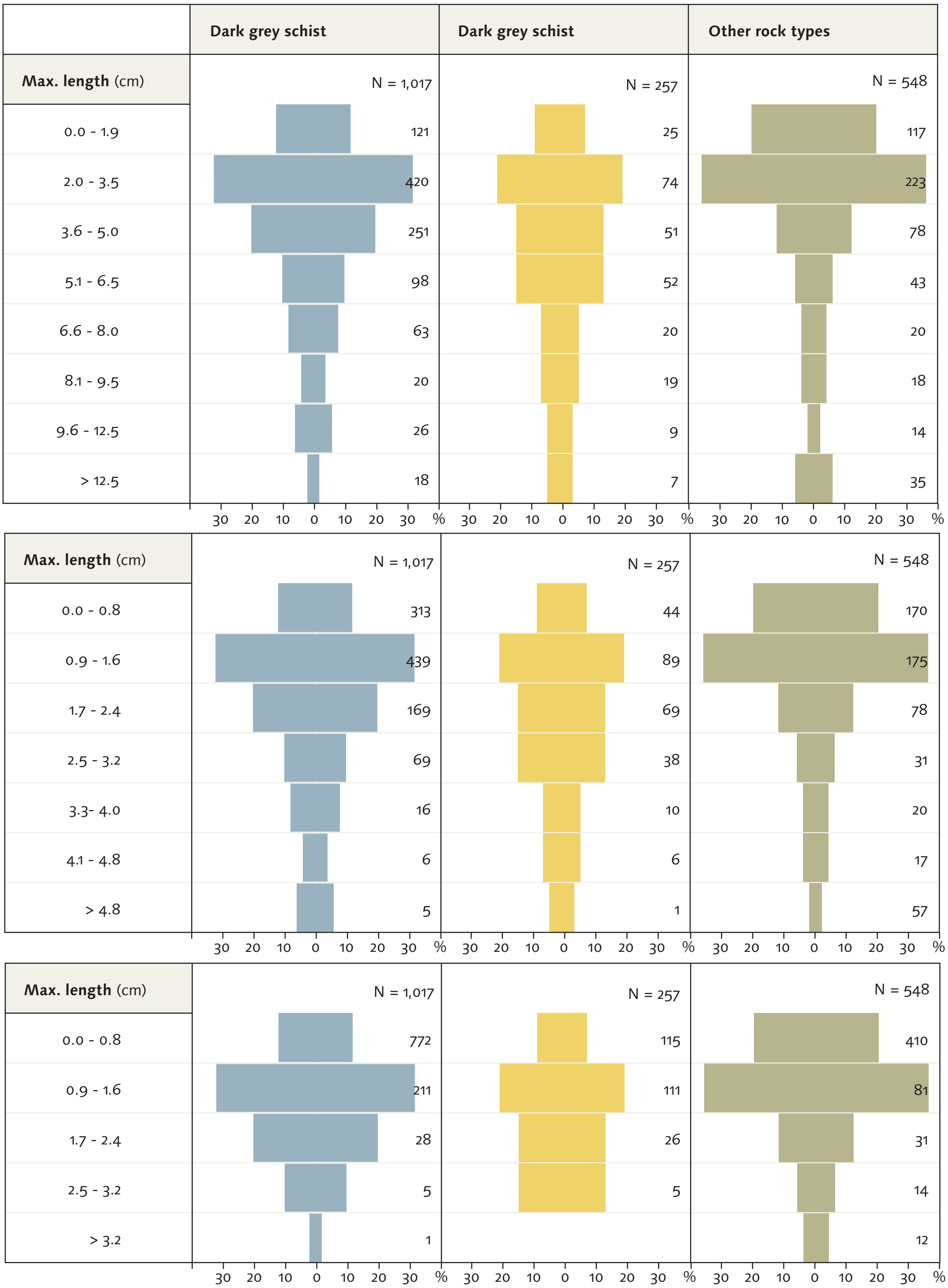
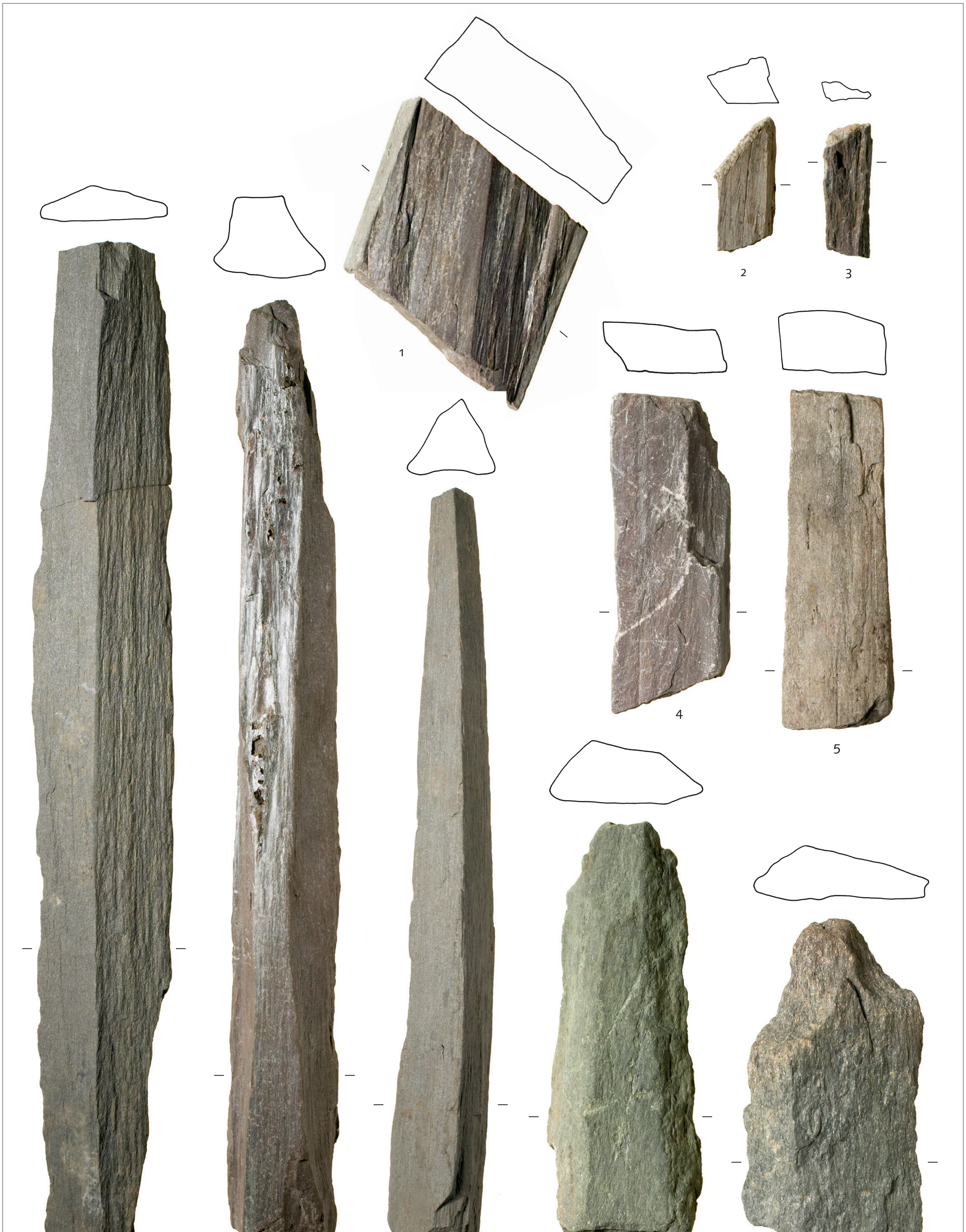


Figure 14.3 *Whetstones and grindstones by length, width and thickness.*

Figure 14.4 *Whole and divided blanks for whetstones with no grinding surfaces. Dark grey schist (1, 2 and 4), light grey schist (5), schists like dark grey schist (6–8), green schist (9–10), unidentified schist-like stone (3).* ***1:*** *C52519/23239;* ***2:*** *C52519/20986;* ***3:*** *C52519/27392;* ***4:*** *C52517/1510;* ***5:*** *C52519/19295;* ***6:*** *C522516/3801;* ***7:*** *C52519/28307;* ***8:*** *C52519/2422;* ***9:*** *C52517/1795;* ***10:*** *C52516/585. (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*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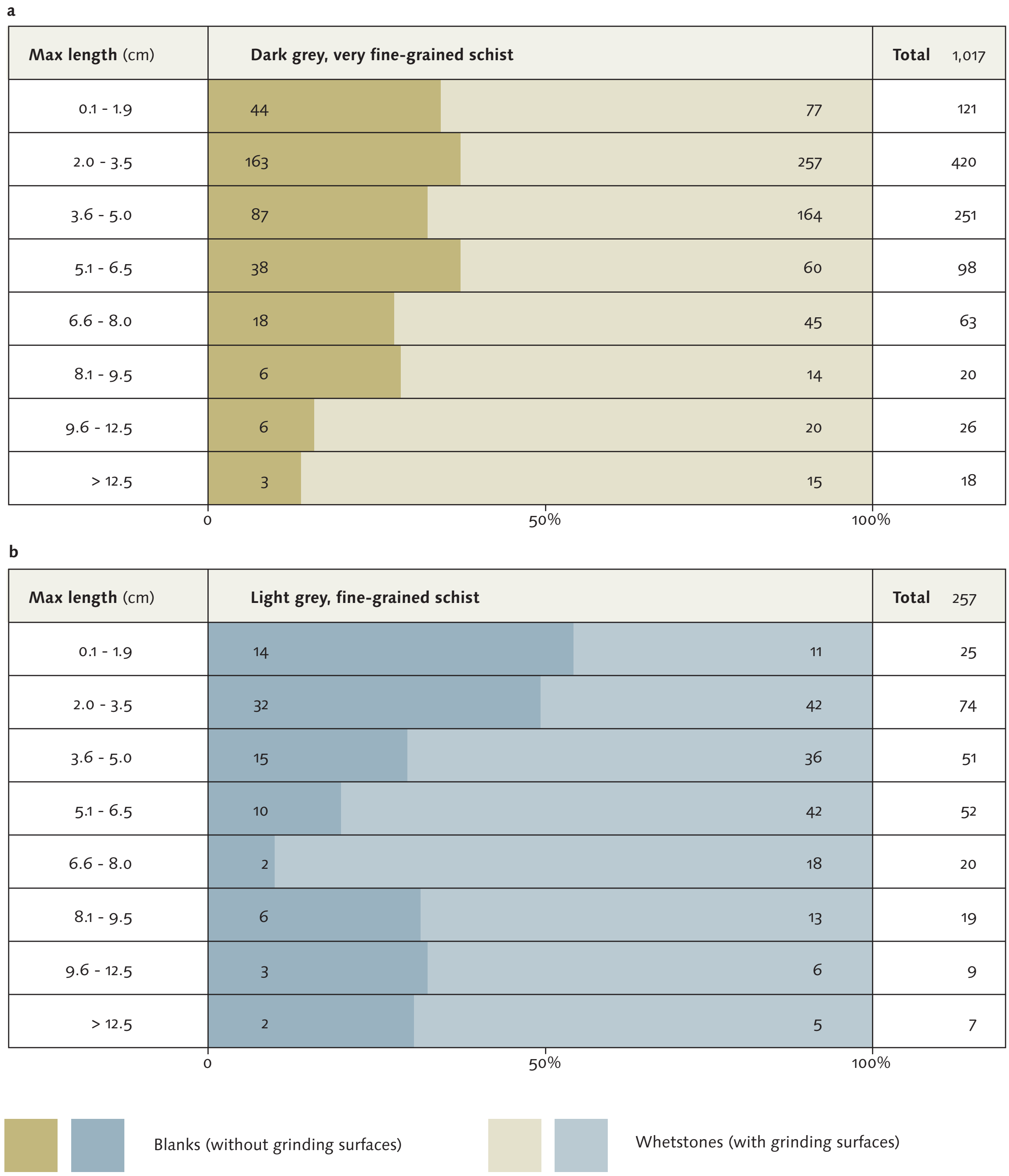
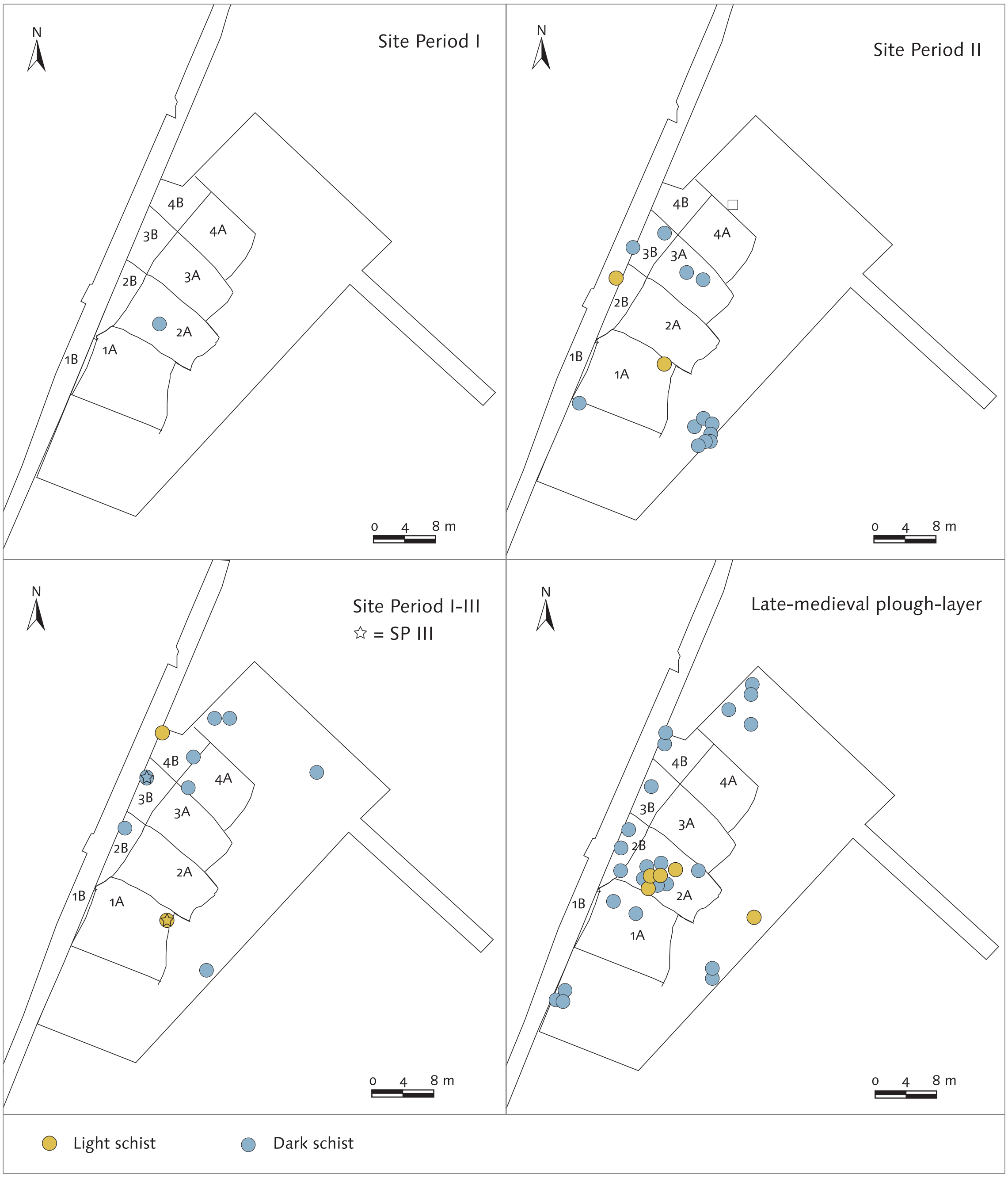


further detail in connexion with the finds from the excavations in the settlement area of Kaupang from 1956 to 1974 (Askvik 2008:8–10). Askvik has further explained, however, that amongst the new finds from Kaupang there are also some types of stone that cannot be identified macroscopically without more thorough investigations (pers. comm.).

The remaining finds that could have been used as whetstones have been grouped into three sets by the present author: dark grey schist, light grey schist, and other types of stone (Fig. 14.1b). It is relevant to note that the finds include a considerable number of very small sieved finds. This is reflected by the data on count and weight. In Askvik's view, sieved-out stones from the subsoil that can only with difficulty

Figure 14.5 *The proportion of the assemblage consisting of blanks and whetstones, classified by length.*
a) Dark grey, very fine-grained schist.
b) Light grey, fine-grained schist.

Figure 14.6 *Unworked blanks of dark and light grey schist more than 50 mm long. Distribution of finds by Site Period in the MRE. Map, Elise Naumann.*



be identified macroscopically can also be included as possible raw material in the category of "other types of stone".

14.2 Whetstones and grindstones

Most of the sharpening tools of stone survive as worn-down and often broken remnants. They consequently represent only parts of the original objects. Re-use is common. Both complete whetstones and fragments may have traces of whittling or deliberate cutting up and shaping to prepare them for further use. When assessing the size of the finds it is therefore important to remember that these are remnants. It is difficult, as a result, to draw a clear distinction between bar-shaped whetstones and grindstones, as fragments of stones can be re-used as whetstones. If the criteria of size, signs of use and material were considered, the boundary would be a fluid one. A review of the length, width and thickness of the sharpening tools shows nonetheless that there may also be various classes of implement amongst the finds of other types of stone than light or dark grey schist, such as bar-shaped whetstones and grindstones (Fig. 14.3).

Blanks

Finds of surviving whetstone-blanks, in what are thought to be the original size, are rarities on Viking-period settlements. Both blanks and large well-preserved whetstones are more readily sup-

Max length (cm)	Dark grey, very fine-grained schist	Light grey, fine-grained schist	Other rock types	N
0.0 - 1.9	1		1	2
2.0 - 3.5	3		1	4
3.6 - 5.0	11	5	3	19
5.1 - 6.5	2	3		5
6.6 - 8.0	5	2	1	8
8.1 - 9.5	1	2	1	4
9.6 - 12.5	4			4
12.6 - 15.5	1		1	2
> 15.5	4	1		5
Total	32	13	8	53
%	0 10 20 30 40 50	0 10 20 30 40 50	0 10 20 30 40 50	

Figure 14.7 *Fully preserved bar-shaped whetstones. Maximum length in the various categories of raw material. Illustration, Elise Naumann.*

Figure 14.8 *Whetstones of dark grey schist (1–5) and hornblende schist (6). One whetstone has marks of whittling along the entire side before damage and re-use (4), another has an unfinished suspension-hole (5).* ***1:*** *C52519/9652;* ***2:*** *C52519/28904;* ***3:*** *C52519/12810;* ***4:*** *C52519/9616;* ***5:*** *C52519/11850;* ***6:*** *C52516/2407. (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 14.9 *Whetstones of light grey schist of various sizes.* ***1:*** *C52519/18890;* ***2:*** *C52519/19597;* ***3:*** *C52519/38550. (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 14.10 *Whetstones of light grey schist. One whetstone has longitudinal grinding grooves on all sides (3).* ***1:*** *C52516/4035;* ***2:*** *C52516/5467;* ***3:*** *C52519/12089. (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.*

Figure 14.11 *Whetstones with drilled holes for suspension (1–6, 13–14), narrow, regularly shaped whetstones (7–11), whetstones with a notch for suspension (12 and 15), whetstone with whittling or sawmarks as preparation for breaking up (16), and whetstones with longitudinal smoothing grooves (14 and 17). Dark grey schist (1–5 and 7–17), quartzite (6).*
1: *C52519/11458;* ***2:*** *C52516/1512;* ***3:*** *C52519/9761;*
4: *C52519/9917;* ***5:*** *C52517/1605;* ***6:*** *C52519/10855;*
7: *C52516/971;* ***8:*** *C52517/1453;* ***9:*** *C52516/4265;*
10: *C52516/4441;* ***11:*** *C52517/1114;* ***12:*** *C52519/10499;*
13: *C52516/5469;* ***14:*** *C52517/2260;* ***15:*** *C52519/11060;*
16: *C52516/45; 17: C52517/1477. (Scale 1:2).*
Photo, Eirik Irgens Johnsen, KHM.
Drawing, Bjørn-Håkon Eketuft Rygh.

Figure 14.12 *Grindstones (1–3 and 5–8) of sandstone and a possible touchstone (4) of black calcitic mudstone or schist. Stones with grooves from use or for the intended cutting of the stone (1 and 6–8).*
1: *C52519/20379;* ***2:*** *C52519/12026;* ***3:*** *C52516/5756;*
4: *C52519/27521;* ***5:*** *C52517/1433;* ***6:*** *C52519/25533;*
7: *C52519/24780;* ***8:*** *C52516/3859.*
(Scale 1:2). Photo, Eirik Irgens Johnsen, KHM.
Drawing, Bjørn-Håkon Eketuft Rygh.

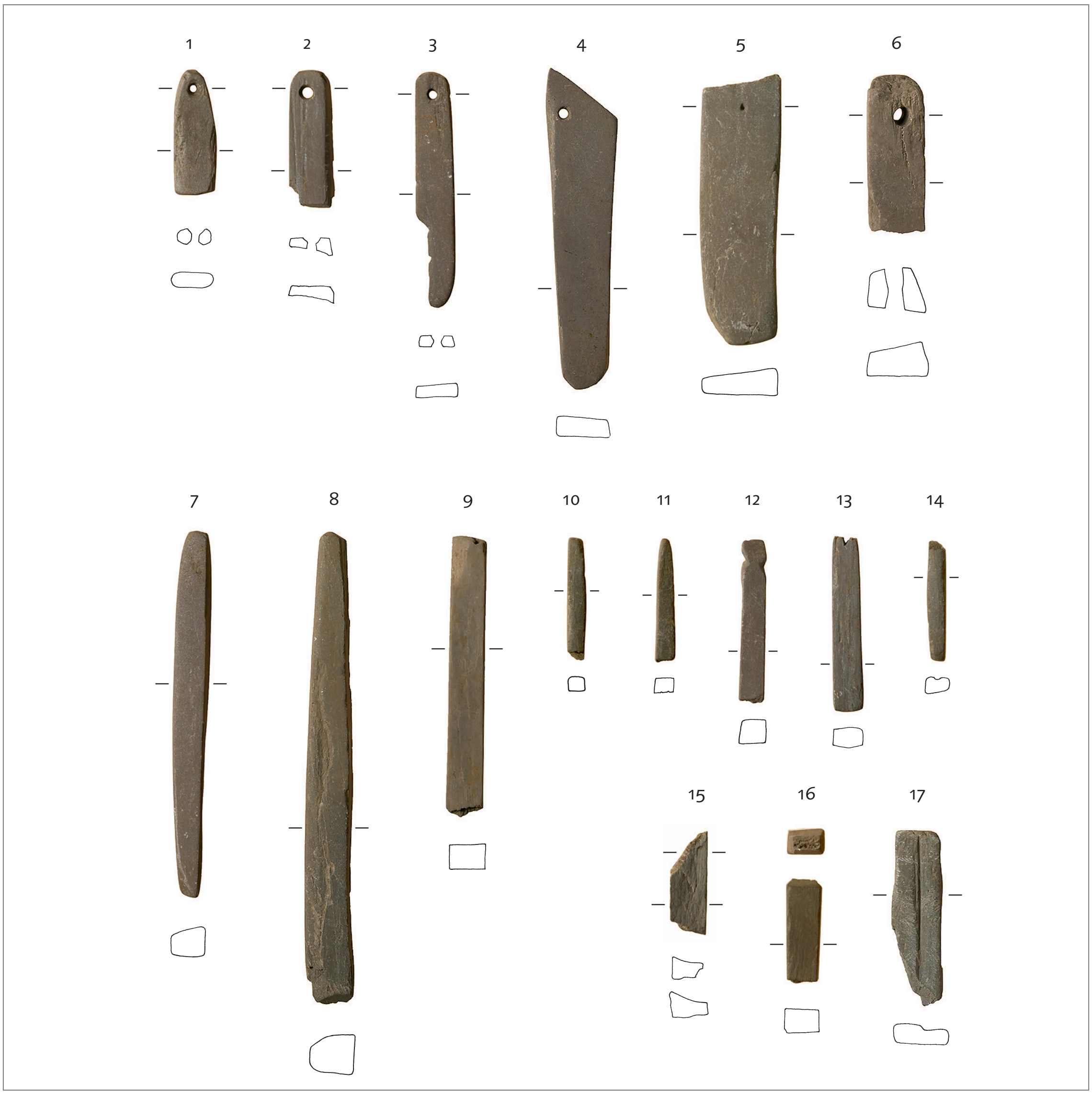



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Figure 14.13 *Rotary grindstone with cutting marks from secondary division (1) and grindstone (3) of sandstone; cut fragment of a boulder of feldspar/monzonite? of unknown function (2). **1:** C52516/6192; **2:** C52516/846; **3:** C52519/12087. (Scale 1:3). Photo, Eirik Irgens Johnsen, KHM.*

posed to have been hidden or lost. At a few later medieval sites, by contrast, such as Handelstorget in Skien and Mindets tomt in Oslo, large stores of whetstone-blanks have been found that can readily be associated with the market (Myrvoll 1992; Lønaas 2001:92). From the settlement excavations at Kaupang of 1956–74 only one whetstone-blank is known, 288 mm long and 457 g in weight, of dark grey schist (Resi 2008:pl. 2.1). An unworked blank of light grey schist more than 370 mm long from grave Ka. 264 at Nordre Bikjholberget shows what size the blanks of this material could be (Blindheim and Heyerdahl-Larsen 1995:pl. 75k).

There is a surprisingly large number of relatively long or wide unworked blanks of both light and dark grey schist, as well as of other types of stone, from the excavations of 1998–2003. Some of the longest, of types of stone very similar to dark grey schist, measure 290–380 mm (Fig.14.4.6–8). Others, of dark grey schist and greenschist, are 60–80 mm wide (Fig. 14.4.1, 9 and 10). In several cases the original quartz-covered split surfaces of quartz veins from the rock are preserved on one end, and the blank has thus a terminal that it must have been given in the quarry (Fig. 14.4.2–3). This occurs also on some finished whetstones. Traces of blows or cuts at the crossing end of both larger (Fig. 14.4.7) and smaller blanks can be regarded as representing how the breaking up of the raw blocks was done in the quarries, and possibly also at Kaupang too.

A high proportion of the recorded raw material for whetstones of dark and light grey schist from Kaupang consists of small fragments up to 50 mm long (Fig. 14.5). Many of these may well be splinters from larger whetstones and not really pieces of raw blocks. In an attempt to localize possible concentrations of raw material which might show where raw blocks might have been cut up, a distribution map of unworked blanks more than 50 mm long was drawn (Fig. 14.6). These maps show finds from the Site Periods identified (Pedersen and Pilø 2007; Pilø and Skre, this vol. Ch. 2). Finds of raw material of dark grey schist that can be assigned by Site Period are minimal in the case of SP I (1), but present as a diffuse scatter over much of the excavated area in SP II and SP I–III. There is a notable concentration of finds in SP II:2 east of Plot 1A in a midden area linked to Building A200 (Fig. 14.6; Pilø 2007d:206). Only an insignificant quantity of raw material of light grey schist can be assigned to SP II or SP I–III. The largest assemblage of both types of raw material is from the Late-medieval plough-layer (Fig. 14.6).

Bar-shaped whetstones

There are 870 bar-shaped whetstones altogether. The majority of these are of dark grey, fine-grained schist (652; 74.9%). There are 173 (19.8%) of light grey, fine-grained schist, while the remaining 45 (5.1%) are of other types of stone. Length, width and thickness vary in each of these categories. Differences in length appear when one compares the length of fully preserved whetstones (Fig. 14.7) and of all the finds (Fig. 14.3). The longest complete whetstones are of dark and light grey schist: 193 and 202 mm long respectively. An examination of the proportions has shown that the dark grey schist whetstones are generally longer than all the others (Fig. 14.8.1–5); the whetstones of light grey schist are generally shorter (Fig. 14.9). Both the whetstones and the grindstones of other types of stone are more uniform in proportions: shorter and wider than the schist whetstones.

Shapes in cross-section vary quite widely, depending upon use but also upon the shape of the whetstone-blank before it was used. Regular square or rectangular cross-sections predominate amongst whetstones of all types of material (Figs. 14.8.2–3 and 5, 14.9.1–3, 14.10.1–2, 14.11.2–13 and 16). Oval or round cross-sections, which were common on quartzite whetstones of the Early Iron Age, still occur but are relatively rare (Fig. 14.11.1).

The outline of the terminals of the whetstones (facing both the broader and the narrow side) show

1

3

2

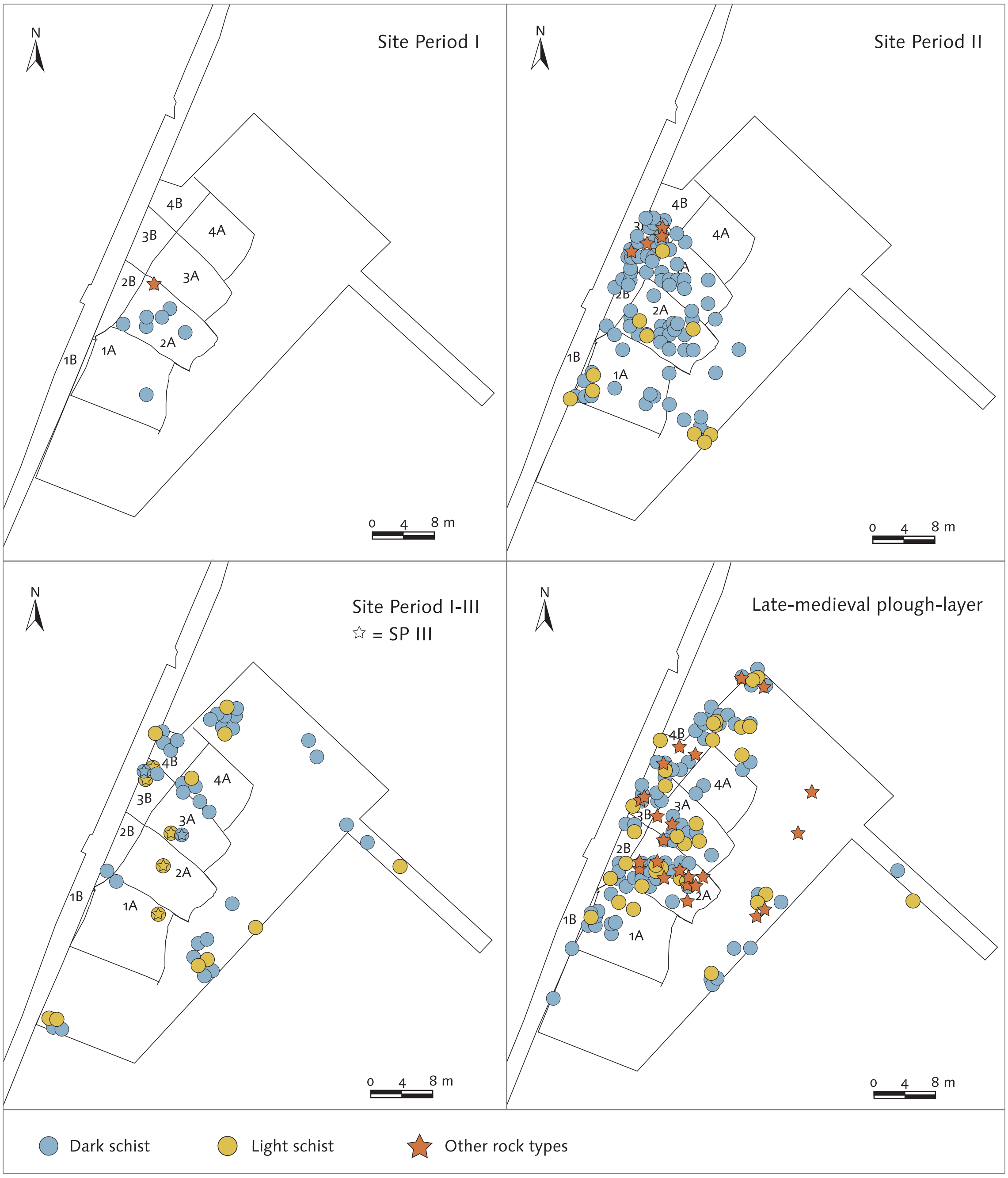


Figure 14.14 *Grindstone of strongly lithified sandstone with evenly smoothed surfaces. One of the broader sides has parallel sharpening grooves in the centre and a hollow along the cross-edge, the opposite broader side has a conical pit, regularly smoothed round. C52516/3855. (Scale 1:2). Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

Figure 14.15 *Distribution of bar-shaped whetstones of dark grey schist, light grey schist, and other types of stone, across the different Site Periods in the MRE. Map, Elise Naumann.*

that equivalent or very similar shapes are very often combined with one another. The majority of the whetstones have a straight or diagonally shaped terminal viewed from either side, or a rounded end. In many cases the terminal has intentionally been shaped carefully and regularly (Figs. 14.8.5, 14.11.1–3 and 8–10). It is clearly quite uncommon for the terminals to have been produced by use.

Whetstones of all types of stone have been subject to heavy wear in the central area. This is particularly the case with whetstones of light grey schist, where the wear has frequently caused the whetstone to break (Fig. 14.10). There are, however, many cases of broken pieces of whetstone having been re-shaped so that they continue to be used for as long as pos-

sible, a sign of the worth of this material. Marks of whittling or notches preparing the stone for cutting are particularly clear where the process was successfully completed, either along (Fig. 14.8.4) or across the whetstone (Fig. 14.11.16). In many cases it is unclear whether grooves or traces of cutting can be attributed to an intention to cut the stone or were produced by the sharpening of iron tools (Figs. 14.13.1 and 14.14b). A few whetstones and grindstones have clear shallow grooves or cuts that show that they were used to sharpen tools with a sharp point, such as pins, while others with deep V-shaped grooves may have been used for sharpening edges. Many parallel grooves (Figs. 14.10.3 and 14.14b) may represent the repeated sharpening of the same type of tool (Sundbergh 1976:16–21; Sundbergh and Arwidsson 1989:108–10)

The distribution of bar-shaped whetstones in datable contexts shows, in the case of the dark grey schist specimens, a limited but conspicuous area of use as early as SP I on Plots 1A and 2A (Fig. 14.15). Their presence on Plot 2A must be regarded with a degree of reservation (Pilø, this vol. Ch. 10:287). In SP II there is evidence of a wide distribution across all plots except for 4A and 4B, and, rather less precisely, in SP I–III. The Late-medieval plough-layer, as expected, has produced considerable numbers of finds in every area of excavation.

The light grey schist whetstones are widely distributed but thinly represented over much of the area of excavation in SP II and SP I–III. They do not occur in SP I, but are well represented in the Late-medieval plough-layer (Fig. 14.15).

The distribution of whetstones of types of stone

Figure 14.16 *The distribution of suspended whetstones across the different Site Periods in the MRE. Map, Elise Naumann.*

other than dark or light grey schist shows a small cluster of finds in SP II on Plot 3B (Fig. 14.15). A single find from the near neighbour Plot 2A of SP I can scarcely draw the whole group so early in date, especially in light of the doubt that hangs over this context (Pilø, this vol. Ch. 10:287). There are considerable numbers in the Late-medieval plough-layer.

A review of the bar-shaped whetstones from the excavations in the settlement area at Kaupang of 1956–74 identified two groups based upon proportions. One comprised whetstones with a suspension hole, known as suspended whetstones. These are of relatively uniform proportions, both longer and narrower than other bar-shaped whetstones. The other group, which is experimentally labelled "small special whetstones", consists of whetstones that taper towards the top when facing the broader side and to the bottom when facing the narrow side (Resi 2008:pl. 7.7–8 and 10–12). The new excavations produced only six specimens of the latter group while suspended whetstones are more numerous.

Nineteen of the bar-shaped whetstones have suspension holes (Fig. 14.11.1–6 and 13–14) while a further ten have unfinished drilled holes or holes marked out in dots (Fig. 15.11.5). Nearly all of these are of dark grey schist, with only one of light grey schist and two of other types of stone. The drilled holes are more or less hourglass-shaped because they were drilled from both sides; they are 2.3–5.0 mm in diameter (Fig. 14.11.1–2). Two specimens have breaks at the hole (Fig. 14.11.13–14); another has a notch that may have been meant for suspension (Fig. 14.11.12). The mode of suspension itself (a cord or ring?) does not survive in the settlement evidence, but remains of iron rings are known from two graves (Ka. 259d and Ka. 307i; Resi 2008:pl.16:1 and 4). The suspended whetstones are relatively small and light. The majority of them had been carefully shaped, but others are more random and may reveal secondary re-use (Fig. 14.11.5–6).

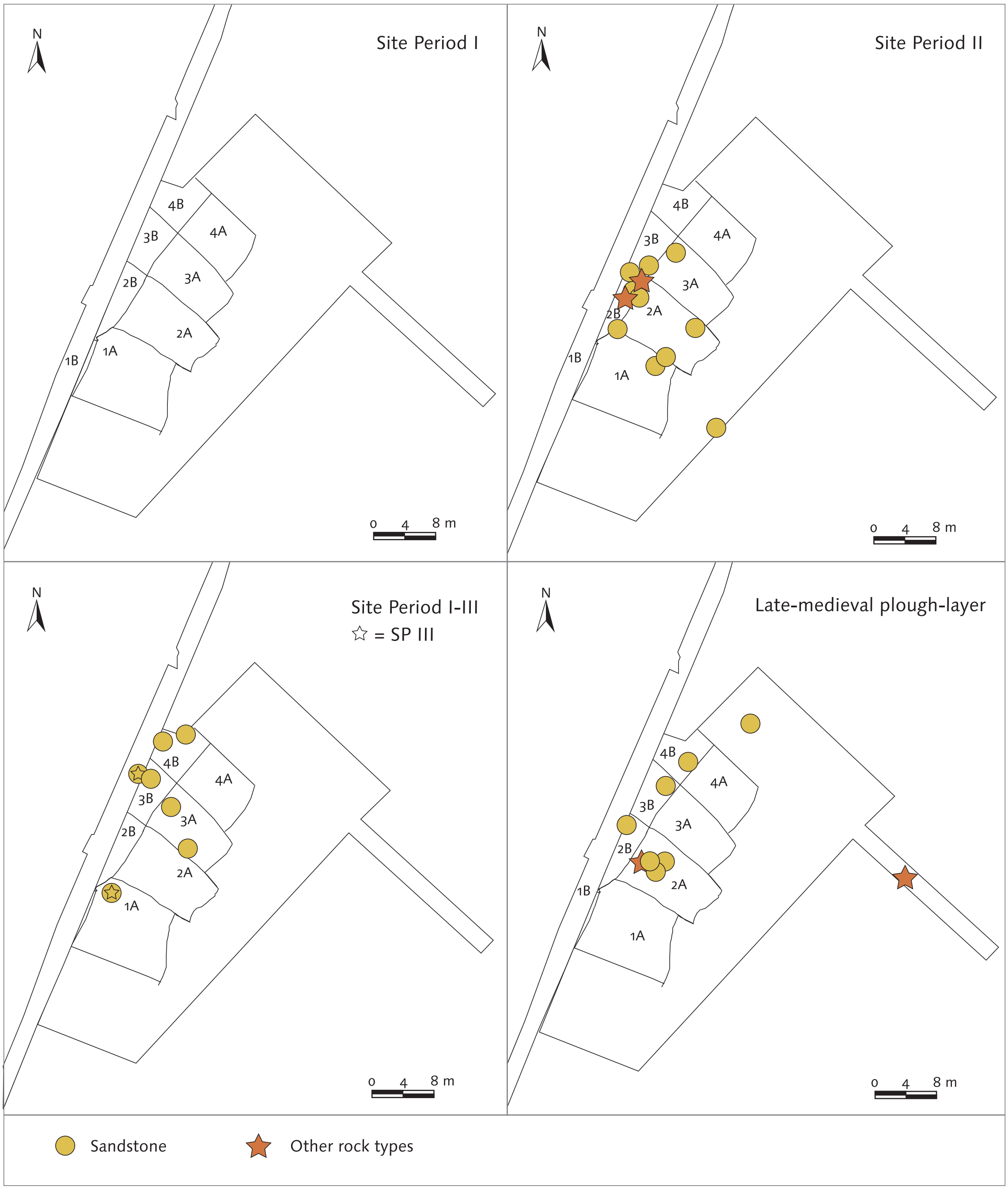
Whetstones that can be assigned to datable contexts are all of dark grey schist (Fig. 14.16). Two of these were found scattered in layers of SP II, two in layers of SP I–III, and all the rest in the overlying Late-medieval plough-layer. From other places, the vertical spread of suspended whetstones is known over an extensive part of the area of excavation. This was equally the case with the finds from the settlement excavations at Kaupang of 1956–74 (Resi 2008:39, fig. 20). It is logical to regard these as personal equipment that was commonly mislaid here and there.

Seventeen suspended whetstones were found in the excavations of the settlement area of 1956–74. This type of whetstone occurs in both men's and women's graves in the cemeteries at Kaupang (5 male, 5 female and 2 stray finds). Jan Petersen dated these primarily to the Later and Very Late Viking Period. In his corpus of 71 specimens, 57 were from male graves and 14 from female (Petersen 1951:256). Many scholars refer to the suspended whetstones as pin-sharpeners and regard them as special implements for this purpose (Blindheim et al. 1999:131). Others believe they may have had various functions, as in graves they are often associated with other tools that would have needed sharpening.

Grindstones

No fewer than 78 grindstones were unearthed in the excavations of 1998–2003. This is a remarkably high number in comparison with the 16 grindstones from the settlement area found in 1956–74. Sixty-seven of these are sandstone, mostly of green or reddish variants. The remainder are of basalt and diabase (2), microsyenite (1), quartzite (1), volcanic rock (2), greywacke (1) and various schists (3), with one of an unidentified type of stone. There are also 11 possible grindstone-blanks.

The largest of the grindstones that is fully preserved is a naturally rounded block of sandstone of



about 5.8 kg, measuring 384 x 240 x 41 mm. It has signs of a concave, rubbed down surface on one broad side. Only three other grindstones can be described as complete or nearly fully preserved (e.g. Fig. 14.12.2). These also have sides smoothed down, although it is not clear that these sides were also used for grinding or that the stones were deliberately shaped. The majority of the finds are fragments of quite thin sandstone blocks with signs of one to three grinding surfaces (Fig. 14.12.1–8). Only a few have V- or U-shaped sharpening grooves.

One peculiar find is a grindstone of strongly lithified sandstone (Fig. 14.14). Both its long sides and broad sides are evenly worn down. On one broad side there are signs of four U-shaped and two V-shaped sharpening grooves, which lie parallel (Fig. 14.14b). A worn hollow along the cross edge and a rather shorter counterpart (41.5 mm long) across this can be interpreted as preparations for cutting over the block (Fig. 14.14b). On the other broad side there is a regularly rubbed-around, conical hollow, 35–40 mm in diameter and 23 mm deep (Fig. 14.14a). The interior of the hollow has a completely smooth polish which must have been produced by friction with some softer material of stone or metal. That this stone was used for sharpening seems to be confirmed by the grinding marks on the sides and in the grooves, but it is uncertain if the hollows and pits

Figure 14.17 *The distribution of grindstones across the different Site Periods in the MRE. Map, Elise Naumann.*

noted here are also to be connected to this function.

Parallels to the conical hollow are known on two finds of rotary grindstones from Coppergate in York, each with two hollows like the Kaupang example (Mainman and Rogers 2000:2481). A possible function has been suggested with the hollows being used to hold or guide the rotation of the rotary grindstone. Three matching hollows are present on a rotary grindstone from Hedeby (Resi 1990:Taf. 27.3), where they are interpreted as marks of secondary use in the form of hemispherical drilled holes. With the information on the finds from York it is appropriate to re-assess the hollows at Hedeby, and to consider these in connexion with the function of the rotary grindstones.

There are further known parallels from Helgö: from Building Group 3 there are four smaller pieces of stone with hemispherical hollows. These were formerly interpreted as crucibles, but an identification as small pits in which to mix metals has now been suggested (K. Lamm 2008:197–8, fig. 26). Similar hollows are also present on further, more or less worked blocks of sandstone from Helgö (J. P. Lamm 2008:112–14, figs. 19–20; Kresten 2008:148, fig. 2).

The grindstone with the conical hollow from Kaupang bears no signs of having been used as a rotary grindstone. On one side it has quite long sharpening grooves. Otherwise, it has several evenly smoothed surfaces, as well as signs of shaping for which, as yet, there is no good explanation. It is conceivable that the hollow may be the result of secondary use of the grindstone, for instance as the bolt-hole for a door. A metallurgical explanation of the conical hollow, as has been proposed for comparable finds from Helgö, is also realistic.

The grindstones that can be assigned to datable contexts at Kaupang occur in SP II and SP I–III, but not SP I (Fig. 14.17). There is a possible cluster of grindstones on Plot 2B in SP II (alongside structure A89947; Pilø 2007d:111) and in the adjacent part of Plot 3B. These might be linked to some productive activity in this area. The quantity of finds that ended up in the Late-medieval plough-layer compared with that in SP II is lower than with other categories of find.

Rotary grindstones

There is one rotary grindstone of sandstone amongst the new finds from Kaupang (Fig. 14.13.1). This is c. 42 cm in diameter and around 12% of the diameter is preserved. One side is well preserved but the opposite is damaged and delaminated, and the stone survives to a thickness of 35–47 mm. It is clear that this stone was being cut up from both sides for some further use when it was discarded.

From the settlement excavations at Kaupang of 1956–74 there are fragments of two similar rotary grindstones, both of sandstone and c. 21 and 40 cm in diameter respectively (Resi 2008:42, pl. 12). Stones like this are otherwise quite rare as Norwegian Viking-period finds. A three-quarters preserved stone from a Viking-period burial at Kvelde, Hedrum, Vestfold (C12525), c. 26 cm in diameter and 70–87 mm thick, is a close parallel to the finds from Kaupang. This category of find is also well represented in comparable major Viking-period settlements such as Dorestad (Kars 1983), Hedeby (Resi 1990) and York (Mainman and Rogers 2000).

14.3 Touchstones?

Touchstones are usually made of relatively hard black stones that are well suited for scratch-testing precious metal objects. Possible touchstones have been noted amongst the finds from Dorestad (Kars 1983:25–6) and Hedeby (Resi 1990:39–40). Three finds from the investigations of 1998–2003 might, from their form and type of stone, be touchstones. Two of these are formed as precisely shaped square plates that taper a little in width approaching the end which is perforated for suspension (Fig. 14.18.1–

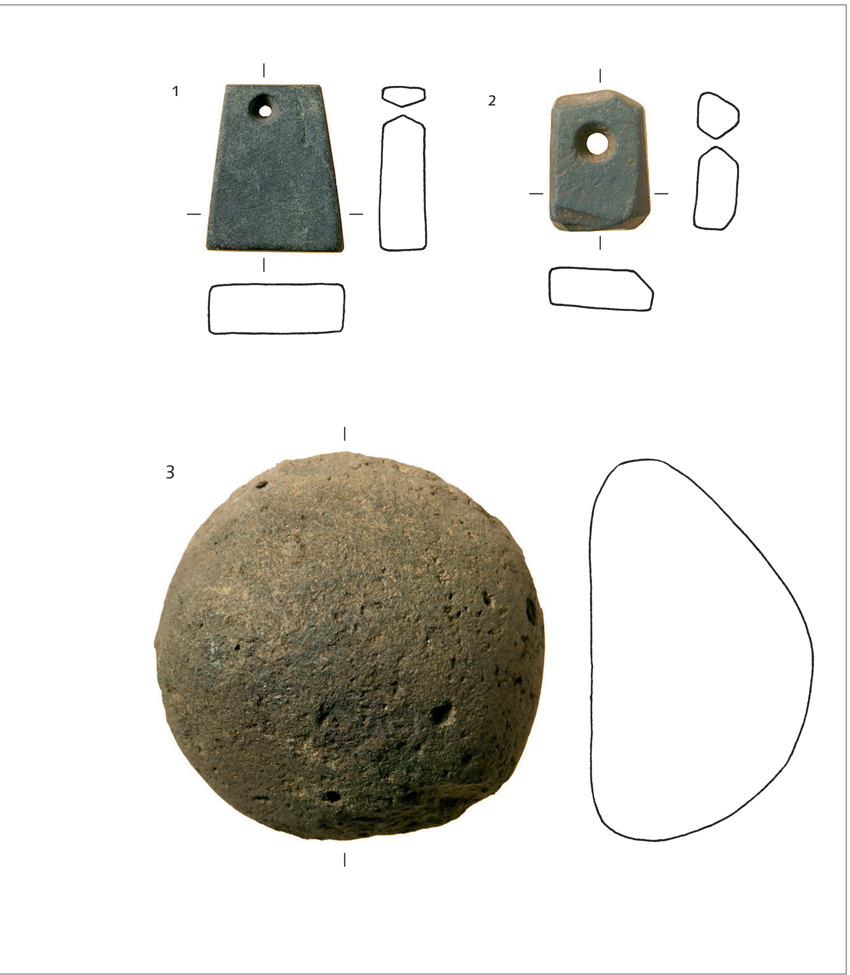


Figure 14.18 *Possible touchstones or pendants of black, calcitic mudstone or schist (1–2).* **1:** *C52519/28897,* **2:** *C52516/3710,* **3:** *C52516/1483. Scale 1:1. Photo, Eirik Irgens Johnsen, KHM. Drawing, Bjørn-Håkon Eketuft Rygh.*

2). The third is a somewhat larger, thin plate with evenly smoothed sides (Fig. 14.12.4).

Inge Bryhni of the Geological Department of the Museum of Natural History of the University of Oslo, has assessed the objects geologically, and his report includes the following:

> The stone of the three samples from Kaupang is so fine-grained that it is very difficult to see the individual mineral grains except under a microscope. From the chemical analyses, however, we can infer that all of them probably consist of carbon-rich particles, carbonate minerals (calcite, dolomite and/or ankerite), a little quartz and mica. The high level of phosphate shows that there is also apatite in the stone, and the presence of sulphur shows that some pyrites (iron pyrites) were close by.
>
> The large plate [Fig. 14.12.4; C52519/27521] looks slightly vitrified, but it is also possible to see some slight, bowed, toolmarks on it. The small cut plates also have toolmarks, clearest on C52519/28897 [Fig. 14.18.1], where it is possible to see engraved lines along, across and diagonal to the longer edge. Here there is still a small, blank fleck of metal in one of the lines along one of the long sides; it may have come off a pin.

After assessing the chemical analyses Bryhni provisionally describes the stone as follows: "*black calcitic mudstone* – or when it is schist-like, *black calcitic schist*" (2007:2).

From the work in the settlement area of 1956–74 there are two further possible touchstones, geologically identified as greenschist (Resi 2008:pl. 13.1–2). Both are perforated for suspension. It is difficult to declare with certainty that the five stone objects from Kaupang discussed here were used as touchstones as four of them might have been pendants. However the "small, blank fleck of metal" seen on the side of one of the stones (Fig. 14.18.1) may support its identification as a touchstone.

14.4 Smoothers

Two flattened round stones of microsyenite (Fig. 14.18.3) were found during the excavations. These are naturally formed stones from moraine or a beach area, such as often bear marks of polishing or scoring, just as the two from Kaupang. Similar objects were found during the excavations of the settlement area in 1956–74 (Resi 2008:pl. 13.3–5). Matching "egg-shaped stones" occur both in men's and women's graves: e.g. Ka. 296 and Ka. 304 (Blindheim and Heyerdahl-Larsen 1995:pl. 63p).

Jan Petersen (1951:328–9) discussed Late Iron-age seam-smoothers of glass, and also in the form of pebbles. Their function is most commonly associated with textile-production, for the smoothing of linen in a damp state (seams and cuffs). However other interpretations may be valid, such as the smoothing of surfaces on ceramic products or smoothing during metalworking.

14.5 Concluding assessment

In the course of a few decades, a number of maps and tables of the distribution of types of stone used for sharpening tools from sites of the Viking Period and Middle Ages in Scandinavia, Germany, the Netherlands and Great Britain have been published (Mitchell et al. 1984; Myrvoll 1985:37; Crosby and Mitchell 1987:fig. 5; Gabriel 1988:Abb. 57, Tab. 2; Sindbæk 2005:144–5, fig. 6.7). The main issue is the widespread distribution of what is known as Eidsborg schist, often, it has to be admitted, with reference to sites with very small quantities of finds. There is also a similarly wide distribution of stone like the dark grey, very fine-grained, schist from Kaupang, but the assemblage is composite, and various suggestions have been made as to the provenance of the stone.

No whetstones of light grey, "Eidsborg" schist are recorded from the earliest phase, SP I, at Kaupang, but such are found in all later contexts. Dark grey schist, by contrast, was in use throughout the period of settlement here (Figs. 14.6–7 and 15). Finds of large blanks, particularly of dark grey schist but also of the light grey, allow one to infer that this was the original form in which the material was supplied, and that the blanks were broken up further and the whetstones shaped at the site. Carefully selected schist of these qualities was not available in unlimited quantities at Kaupang; these were scarce commodities. Whetstone-fragments were evidently used for as long as possible. The two most valuable types of schist were treated in much the same way at Hedeby (Fig. 14.1; Resi 1980:16, Abb. 2, 2008:24–5, fig. 2). These two towns may, along with other similar places, have been consumers in the same market.

The number of large blanks from the Kaupang investigations of 1998–2003 is significantly higher than that from earlier excavations in the settlement area. Compared, however, with the finds from medieval Skien and Mindets tomt in Oslo, where large quantities of blanks were found in clusters, there is no reason to imagine that Kaupang was a collection point or possible export point for whetstones.

The differences in the relative quantities of the various types of stone amongst the whetstones from the two campaigns of excavation in the settlement at Kaupang are worthy of note (Fig. 14.1a–c; Resi 2008:fig. 2). They may be a reflex of different methods of excavation, with water-sieving in the more recent excavations having produced larger quantities of tiny objects that are difficult to identify geologically. It is nevertheless also possible that the differences are real, and that the two areas of excavation involved different areas of activity within this settlement.

Large amounts of finds of whetstones and grindstones of various types of stone and with a great diversity of marks of use (grinding surfaces, grooves) within an area of settlement may mean that these were essential tools for the on-site sharpening of iron tools that had edges or points. Sharpening tools were also used by blacksmiths and carpenters and in work with bone and horn. Large concentrations of sharpening tools may also be a feature of the deposition of waste. In favourable circumstances a coincidence with production waste of one kind or another will determine the issue. There are few good examples of such concentrations, and no such have been found at Kaupang. Grindstones that are practically earth-fast are often the most reliable indications of the sharpening of edged tools on the spot. An even and diffuse distribution of finds within an area of settlement, as is often the case, for instance, with suspended whetstones, is best interpreted as evidence that these were items of personal equipment randomly lost by their owners within the settlement.

Many different categories of object that have been found at Kaupang reflect strong and direct contact with distant lands within the Viking world. Schist whetstones, however, are amongst the few products that were demonstrably exported from Norway in the Viking Age. Paradoxically, the closest parallels to the assemblage of whetstones, grindstones and possible touchstones at Kaupang are from Hedeby, Dorestad and York, and to some extent also at Fyrkat, Ralswiek and Ribe (Resi 2008:57–66). Through this, and also through the quantity of worn-down high-quality whetstone-stumps, Kaupang reveals its connexion to an international zone.

Acknowledgements

The author is grateful to Helge Askvik for the petrological identification of whetstones and grindstones from the Kaupang excavations of 1998–2003. Ole Christian Lønaas kindly gave permission to refer to his unpublished *hovedfag* thesis in Scandinavian Archaeology from the Institute of Archaeology and Art History, University of Oslo, 2001. Many thanks also to Inge Bryhni, Department of Geology, Museum of Natural History, University of Oslo, for the geological identification of three possible touchstones from the Kaupang excavations of 1998–2003. Thanks also to Hans-Jørgen Berg, who undertook non-destructive analyses with a JEOL JSM 840 scanning electron microscope in support of Inge Bryhni's identifications.

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Part III:

Town and Inhabitants

The Inhabitants: Activities

15

DAGFINN SKRE

By analysing the artefactual finds and building evidence, together with the composition of the occupation deposits from the MRE of 2000–2002, the early 9th-century activities both within buildings and on open plots can be mapped. Most evidence reflects domestic activities and a range of crafts, but also possibly trade.

In the earliest phase (SP I) activity was concentrated on Plots 1A and 3A/B. There is evidence that people prepared and consumed food on these plots, and were occupied in metalcasting, making glass beads, blacksmithing and polishing amber. Evidence of all of these activities has been found on Plot 1A, and it would appear that a different group of craftsmen took over the plot each year.

The six buildings of SP II can, on the basis of structural features, be divided into two groups of three, one group earlier than the other. Both the finds and the style of construction indicate that the earlier group of buildings were for seasonal use, although year-round occupation cannot be ruled out. In two of these buildings there was evidence of a range of crafts.

In the three later buildings there is much less evidence of craft-activity than in the earlier group, and no building housed more than one craft. Combined with the structural arrangement of the buildings, and much more prominent evidence of domestic activity, this shows that these buildings had the same occupants for an extended period: possibly their entire life-time, which must have been two or three decades. Textile production for domestic use shows that there were women resident in all three cases, and each building was probably home to a family.

There is very little continuity in the crafts practised on particular plots from SP I to SP II, and no such continuity between the earlier buildings and the later. There would thus appear to have been substantial changes in the people who used any one plot until the later houses were constructed and settlement became permanent, which was probably in the 820s.

It is not certain whether this development in the types of activity and settlement applies only to the area excavated or to the town more widely. Evidence from other parts of the town hints at the latter.

The subject of this chapter is the activities to which the inhabitants of Kaupang applied themselves. The find material is the clearest relevant source. However there is no direct connexion between the types and quantities of objects found in the occupation layers at Kaupang and the activities that took place there. A range of source-critical problems limit the scope for drawing immediate conclusions from the finds about the spectre and volume of activities and their economic or social significance.

Such conclusions may, however, be supported by looking at the find material within the archaeological context from which it was retrieved, and by comparing the various groups of finds from the one context with one another, both qualitatively and quantitatively, with the source-critical problems kept in view. It is much more probable that an item of equipment that could be used for making glass beads was actually used to do so if it was found in an occupation deposit in a building that also has remains of a furnace and random debris from glass-bead production than if it were found in a rubbish pit with no such associated finds.

Everyone who has worked on settlement finds knows that it is not easy to undertake analyses of activity of this kind. At most sites, and indeed at Kaupang, the majority of the finds and the most significant small finds are from relatively insignificant contexts, such as middens or redeposited layers. The biggest problem in using finds from contexts such as those to analyse activity is that even if they are linked to a particular plot and to other finds from the same place, it is still uncertain where the activity they represent took place. People would discard waste on unoccupied plots nearby. Apparently meaningful associations between finds in a redeposited layer on a plot might in reality be the products of separate activities on different adjacent plots. Furthermore, soil from earlier contexts gets mixed in with later deposits through the digging of pits and trenches.

Nevertheless, amongst the stratified layers at Kaupang of SP I and SP II – from the first half of the 9th century – there are some strata that offer much more secure associations between buildings, hearths and groups of finds. These are the discrete occupation deposits that accumulated in the open air in SP I and were produced within buildings in SP II. In this chapter, these contexts and the finds they contained will be analysed with the aim of reaching conclusions about which activities were practised on open plots and within buildings.[1]

Following these principles, in section 15.1 below a methodology for analysing the archaeological material from Kaupang with regard to the occupants' activities is developed. In the two sections that follow, this analysis is applied to the finds from SP I (15.2) and SP II (15.3) respectively, and a number of general issues are discussed by way of conclusion (15.4). The key points from these discussions are considered in the overall discussion in Chapter 17.

15.1 A methodology for identifying activities

15.1.1 Activities and their traces

Some activities can easily and immediately be recognized in the archaeological finds from Kaupang. The making of glass beads and metalcasting produce so much waste that there can be no doubt if they were practised. Textile production has left many traces in the form of loomweights and spindle-whorls of fired clay, soapstone or lead, while metalcasting leaves behind crucibles, moulds and scrap metal, and amberworking produces offcuts, semi-finished products and the raw material. Sherds of soapstone vessels and animal bones compose detritus which is here attributed to domestic activities: from the repetitive daily round of food-preparation, sleeping, eating, heating the buildings, etc.

It is, however, not just the quantity of waste that activities have left behind them but also the conditions for preservation in the ground at Kaupang that determine which activities can be identified. In this acid and relatively dry soil organic material is very poorly preserved, and this has consequences for tracing several activities.

Antler was used as the raw material for several products, such as combs. The poor conditions for the preservation of antler at Kaupang undoubtedly explain why only a handful of fragments of combs and of other artefacts of such material have been found here. A small amount of production waste has been preserved by chance in favourable conditions, and this is enough to confirm that combmaking and other production using skeletal material as raw material was practised at Kaupang. However, the quantity, date, productive range, quality and location of this activity are unknown. Leather is also poorly preserved, and has scarcely been found at Kaupang except for a few tiny traces in occupation deposits in building A303 (Milek and French 2007:tab. 15.2). There must have been some production of leather goods such as shoes, pouches, clothing, sheaths and the like, but as in the case of antler- and boneworking, there is not sufficient evidence to assess fundamental aspects of this activity.

In the case of most forms of woodworking, only chips are left. These are poorly preserved in the settlement area but can be found in some pits – and in large quantities in the harbour sediments (Barrett et al. 2007:287, 297–9; Milek and French 2007:342, 345–6 and 355–7). But these chips do not reveal whether they were cut off when planks were being made for chests or buildings, road-planking or ships. Nonetheless, there is ample evidence for house-building, and the remains of one post show that the timber was carefully prepared (Pilø 2007a:204). This is also shown by the planks that have been found in wells and pits. Other finds show that boats and ships were probably repaired, and possibly even constructed, in the harbour at Kaupang. Large quantities of rivets have been found, many of them cut through in the manner characteristic of when a cashiered plank is removed from a ship (Resi 2000:144, fig. 2). One piece of iron has also been found with several linked rivet-plates (roves), as they would have been supplied by the smith to the boatbuilder.

There would also have been activities at Kaupang that, by their very nature, leave few if any material traces. The actual trade transactions can be hard to identify, and music, story-telling, prostitution and haircutting are impossible.

In addition to the analyses that are undertaken below, one has to assess to what extent the finds

1 The distribution of specific groups of finds that is discussed here is also considered in other chapters in this volume (Chs. 3–14). Additionally, the detritus from beadmaking is discussed by Wiker (in prep.) and that from metalcasting by Pedersen (2007; in prep.). If these authors reach different results from those in the present chapter it is because they have used finds from all of the contexts in each of the Site Periods and sub-phases of the excavated site.

reflect the activity at the place at which the deposits were left or whether quantities of soil, possibly including the waste from glass-bead production or metalcasting, could have been brought to the spot. The distribution of finds at Kaupang shows that such horizontal movements of finds did take place to a certain extent. Practically all of the major categories of finds occur on all the plots in all of the Site Periods and sub-phases. Such horizontal dispersal of finds would particularly have taken place with the levelling of the ground, the demolition of buildings, and the removal of waste. In this study, however, most of this "background noise" is filtered out by omitting deposits from this kind of activity and by considering only the accumulated occupation deposits.

The movement of deposits into buildings and out to exterior activity areas may nevertheless have taken place, for instance when buildings, furnaces or hearths were constructed, or as material mixed up with fuel. At Kaupang, however, clean clay was usually used for hearths and furnaces, and this will have contained few if any finds. Peat was rarely used as fuel; rather wood (Barrett et al. 2007:287; Milek and French 2007:324). Nevertheless a certain degree of contamination of occumulated deposits must be assumed.

An analysis of the finds in the occupation deposits must, therefore, take account of the fact that several activities of a nature which have left few if any traces, still would have taken place at the locations in which the layers accumulated. Likewise, the traces of activity that can be seen must be assessed with the understanding that there is no direct connexion between the quantity of evidence for activity and the original intensity or duration of that activity. Because of the possibility of the horizontal displacement of finds, in this analysis greater weight is attached to higher quantities and meaningful connexions between several types of find than on minor amounts of small artefact-types which could easily have been deposited through the movement of soil. Individual finds of small artefacts are interpreted with caution.

15.1.2 Activity indicators: quantity and quality

Artefact-types indicative of activities occur at Kaupang both as unique small finds, such as an axe or a tuyère, and in the form of bulk finds. Urban archaeology has seen a long-lasting debate over "bulk finds" (summarized in Frydenberg 2008): most scholars would define this category as constituted of artefact-types that occur in large quantities, with no individual example showing any features of interest or even having been deliberately made. These are artefact-types which are only, or at least are overwhelmingly, subject to quantitative analysis. The discussion has concerned itself with what should be defined as bulk finds, what sorts of questions they can help to answer, how much attention should be paid to them, and so on.

In my view, the sensible approach to this question is to accept that it is not the artefact-type itself that determines which are bulk finds but the questions that are posed when they are analysed. The most prominent features of the hundreds of kilograms of slag from an iron-extraction site, for instance, will usually be their spatial distribution and weight. But if someone finds a method for identifying the slag from each separate smelting, and possibly even from the various phases of smelting, each individual lump of slag will suddenly become of interest, and their analysis may result in production figures relating to each smelting, a chronology of production and deposition of slag, and more. A new method and new questions will turn an assemblage of bulk finds into a collection of unique objects.

The extent to which a group of finds should be treated as bulk finds – i.e., quantitatively – or as unique objects – i.e., qualitatively – thus turns into the question of what an analysis of the group of finds is aiming at. In this chapter and the following one, several groups of finds will be considered both qualitatively and quantitatively – for instance pottery and glass beads, both of which appear as quantitative evidence of domestic activities and as small finds of significance for dating and provenance studies.

Table 15.1 presents an overview of the categories of artefact and material from SP I–II which it is appropriate to consider quantitatively, and of the most significant forms of activity to which these can be linked. As already noted, the range of activities that can be traced is quite limited, and some key activities, such as carpentry, are untraceable.

15.1.3 How to make comparisons

How, then, are differences in the occurrence and quantities of the fourteen indicators of activity to be identified and interpreted? The first thing to consider is the extent to which the occupation deposits that are subject to this analysis have been preserved. This is essential to be able to assess whether the quantities of finds the activities originally produced are represented to a significant extent in the layers that have been excavated.

As Table 15.2 shows, the degree of preservation of the occupation deposits from SP I is indeterminable because it is impossible to estimate the original extent and thickness of these deposits. The degree of preservation of the occupation deposits from SP II are more easily calculated, because the original extent of the buildings is known, or can at least be estimated with a high degree of confidence. The conclusion is that 27–37% of the area of occupation deposits in the six buildings of SP II was preserved (Tab. 15.2). This percentage, however, is not

No.	Find-category	Domestic	Ironworking/Blacksmithing	Metalcasting	Glass-bead production	Textile production	Amberworking	Bone/antlerworking	Other activities
		Type of activity							
1	Unburnt bone	P							
2	Pottery sherds	P							
3	Glass bead	P			S				
4	Whetstone, slate	S	S					S	P
5	Iron fragment	S	S						S
6	Burnt bone	P	S						
7	Fired clay	S	S	S	S				
8	Non-metallurgical slag		S	S	S				
9	Crucible, clay mould			P					
10	Production waste, copper-alloy, lead			P					
11	Production waste, glass				P				
12	Loomweight					P			
13	Production waste, amber						P		
14	Production waste, bone/antler							P	

Primary activity

Secondary activity

Table 15.1 *Overview of the forms of activity that can be identified through the quantitative analysis of fourteen groups of finds. Most of the links between the type of find and the activity should be obvious, e.g. that [1], unburnt bone, is food waste in the great majority of cases. Some types of find, however, require further explanation: [4], whetstones, were used to sharpen edged tools, which were widely employed in the Viking Period for both domestic and other activities. Amongst the craft activities, of which there is evidence at Kaupang, it is only blacksmithing and bone-/antlerworking that, to some extent, made use of edged tools. [5], unidentified iron fragments, may be evidence of blacksmithing (Jouttijärvi et al. 2005:304), but can also be fragments of nails from wooden objects that have been burnt on the hearth, or remains of broken iron tools, etc. This category includes nails, rivets and rivet-plates. [6], food bones, can be used as fuel (ethnographic evidence cited in Bakkevig 2006:21), but bone can also be used to make steel (Gansum and Hansen 2002:4). [7], untempered, red-fired clay, may derive from the normal use of fireplaces, which are indeed built of clay, or from a furnace. [8] What is recorded in the finds' database as "slag" is mostly non-metallurgical slag (Pedersen, in prep.): clay that has been heated to a temperature at which it melts (Milek and French 2007:339). With the minerals in question this takes place around 1200°C (Jouttijärvi et al. 2005:303). So high a temperature will not be reached in a normal, open hearth, but only in a furnace with the aid of bellows. Non-metallurgical slag must therefore come either from the clay of which a furnace was constructed or from clay tuyères.*

high enough to give reliable results in investigations of the distribution of activities within each building, especially not in those buildings where the surviving deposits are concentrated in one and the same part of the structure (A301, A303 and A406). Consequently, only clear patterns in the distribution of finds in the best preserved of the buildings will be considered in the following discussion.

If each building is focussed on, a comparison of the quantity of different types of activity-related finds in the occupation deposits should yield a picture of the relative intensity of the activities or their duration. However, those inferences cannot of course be read directly from the figures: twice the amount of iron fragments compared with burnt and unburnt bone does not mean that there was twice as much blacksmithing as the consumption of meat. Some activities produce a great deal more material than others; small objects will be more likely to have remained in the occupation deposits than larger ones; and many activity-related finds will have decomposed in the soil at Kaupang. An activity that produces a large number of small, heavy, valueless and durable objects will consequently leave many more traces in the occupation deposits than one which produces large, light, useful and perishable material.

It is not possible to calculate the exact significance of each of these factors, so that comparisons of the relative quantities of finds within the outline of individual building cannot be translated simply into the relative intensity or duration of the various activities within those buildings. However, by comparing traces of activity between several buildings, it should be possible to identify similarities and differences in types of activity and their intensity between those buildings. It is credible that a building with a higher frequency of indicators of domestic activity had had people living in it either for a longer period of time, or in greater numbers than one in which less such material was found.

In order to establish comparable figures for each building or area of activity, a density or frequency of finds per 10 square metres has been calculated in respect of the categories of find used in the present analysis. These figures are then compared with similar buildings or areas of activity in cumulative bar diagrams. Some categories of activity indicators, such as fragments from amberworking, however, appear in such small amounts that it is pointless to compare the few grammes of which they are constituted with the kilograms representing some other activities. The amount of finds is thus presented in two diagrams, one for heavier categories of material and one for the light. The boundaries between these two groups are determined by the actual intervals in the range of sizes of the categories of find being compared (see Figs. 15.1 and 15.3–4).

The interpretation of the differences that appear in these diagrams also takes account of significant single finds, the internal arrangement of the buildings and our knowledge of cultural history, as well as the interpretative problems already explained. This analysis will consider material from the four plots, 1A, 2A, 3A and 3B, that make up a large proportion of the excavated area (Fig. 15.2).

15.2 Seasonal activities around AD 800 (SP I)

Although there are finds of SP I from all four of the plots that are discussed here, intact occupation deposits survived on only three of these: 1A, 3A and 3B. The analysis of finds from SP I on Plot 2A shows that these include a wide range of objects that are not otherwise found in SP I, such as relatively large numbers of loomweights (Øye, this vol. Ch. 13:365). Weaving was normally undertaken indoors, although finds of loomweights from Ribe show that weaving could also be undertaken on a seasonal settlement, probably inside a tent. However there are also several other types of find from SP I only found on Plot 2A, so there is consequently little reason to place much reliance on the stratigraphical evidence of SP I on this plot (Pilø, this vol. Ch. 10:287). It would appear that Plot 3 was first divided into two sections, 3A and 3B, in SP II, so that in SP I 3A/B can be regarded as a single plot.

As Table 15.2 demonstrates, occupation deposits are widely preserved, and the surviving area is more or less equal on Plots 1A and 3A/B. The thickness of the deposits varies, however, with those on Plot 1A a good deal thicker – as is also reflected in the density of finds per square metre (Fig. 15.1). This is probably a reflex of the fact that the period of seasonal activity (SP I) was to all appearances longer on Plot 1A than on Plot 3A/B. On the latter double-plot a building was raised early; on Plot 3B possibly after seven years of seasonal activity (Milek and French 2007:329–30).

The traces of domestic activity are clear on both plots. Both pottery and bone, burnt and unburnt, constitute substantial assemblages in both cases. Occupation deposits consist largely of pieces of charcoal (Milek and French 2007:329), which in combination with the large quantity of burnt bone show that there must have been fires on the plots. This is also implied by the quantities of scorched stone that had been dumped outside the fence that marked the lower boundary of each plot (Pilø 2007d:192–5, fig. 10.2–4). Stones like this were deliberately heated in the fire and then placed in a water container so that the water would be heated. The scorched stone shows that at least some of the charcoal, and probably the burnt bones, must come from a fire that was made to prepare food.

It is clear, therefore, that there were hearths on the plots, although no remains of those themselves have been found. They were probably simple fireplaces that were not dug into the ground and which would therefore have been removed in their entirety when the users left the site or through the later clearing of the plots.

The occupation deposits also contained evidence of craft-activity that required heat. On Plot 1A there is clear evidence of the production of glass beads in the form of beads and manufacturing waste, and both plots produced remains of metalcasting. Both plots also had a quantity of fired clay, and on Plot 1A there is a large amount of non-metallurgical slag, which in all probability derives from furnaces that must have been built up there (discussed further in p. 413, below).

One more or less complete crucible has been found on each of the plots (1A: C52519/22735, 3A/B: C52519/26734; Pedersen, in prep.). Single finds of this kind cannot be made to bear too much weight, and only Plot 1A produced further finds that support the conclusion that casting took place there: one frag-

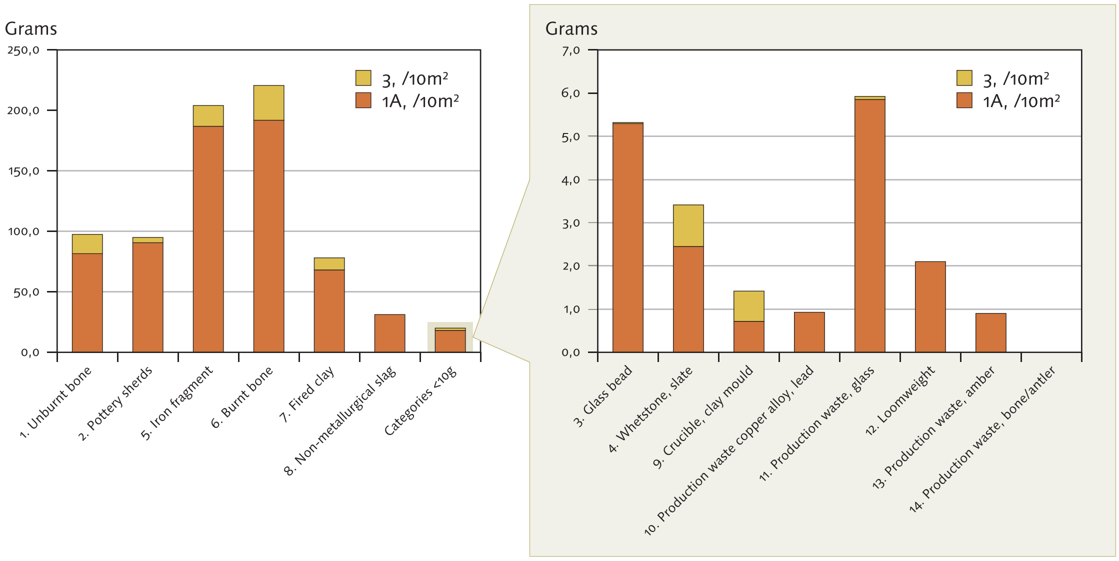


Figure 15.1 *Cumulative bar diagrams of the quantity of finds per 10 sq m in the areas of activity on Plots 1A and 3A/B. Categories of find that weigh less than 10 g are presented altogether in the bar on the far right of the main diagram, and separately in the special chart to the right.*

ment of copper alloy and a lead model for a fluted armring (C52519/23155, C52519/21224; Pedersen, in prep.). The analyses that Unn Pedersen (in prep.) has undertaken reveal that the sherd of a crucible from Plot 1A was made of clay that had been brought in to Kaupang.

The traces of glass-bead production are also much clearer on Plot 1A than on 3A/B. Around 11 g of glass beads and production waste per square metre does not sound much, but the assemblage comprises 44 canes of raw glass, 13 other bits of production waste or raw glass, 65 beads – several of which are failed products and one of them a bead with the iron pontil broken off, manifestly during manufacture. The production waste is of blue and grey-white glass, as used in the great majority of the beads (Pilø 2007d:195; Gaut, this vol. Ch. 9:241–3, Fig. 9.54–5; Wiker, in prep.). The uniform appearance of the raw material and the beads shows that these finds represent a phase of production.

Both plots yielded a considerable number of iron fragments. Plot 1A also produced a few identifiable artefacts. Nine nails, and two rods c. 11 cm long and 100 g and 200 g in weight respectively were found here (C52519/21689, C52519/38860), together with some 300 g of fragments. All of the objects are so badly corroded that there is scarcely any true metal left, so the weights must originally have been much higher. There are no definite signs of which activities would have left the nails. Considered in connexion with the other iron objects and the remains of furnaces, it is reasonable to infer that the nails and other objects could have been made on this plot. The two rods might be parts of tools, other objects, or even ingots.

There is also evidence of amberworking on Plot 1A. One bead and two unfinished beads, a rough-out for a pendant, and eight fragments of production waste leave no doubt what was going on, although the extent of this craft-activity is not evident. One piece of loomweight from Plot 1A is probably intrusive in this context, from a later feature that was not identified during the excavation.

Plot 1A thus has evidence for a range of craft-activities; most clearly the making of glass beads but also, probably, metalcasting, amberworking and blacksmithing. Clear evidence of domestic activities shows that those who practised these crafts prepared and ate their food on the plot, and probably also lived there in a tent, under an up-turned boat or some other shelter which has left no traces. Their periods of residence must, therefore, have been temporary, probably in the warmer season of the year. The finding of several hazelnut shells may show that there was activity on Plot 1A in the autumn months. These nuts usually ripen in September, and they can easily be kept for several months, albeit not until the following summer.

The only group of finds that may give some clues as to where the users of this plot were from is the pottery, which should be regarded as personal property brought along by those who occupied the plot. Of 49 sherds (306 g), one is of Rhenish Walberberg Ware and one of Frisian Shelly Ware; the remainder are grey ware. Three of those can be identified as Slavonic, of either the Sukow or the Feldberg tradition (Pilø, this vol. Ch. 10:300; Skre, this vol. Ch. 16:434–5, Tab. 16.2). The pottery thus corroborates the view that the plot was used by successive groups of people, and suggests that the presence of foreign

Group	Building, Plot	Occupation deposits			Constructional features		
		Estimated size, sq m	Preserved surface, sq m	Depth, cm	Hearth	Roof-bearing posts	Wall-bench in side aisles
SP I	1A		34	3–6			
	3A/B		44	2–3			
A	A303, 3B	27?	7.4 (27%)	2–5	Across	0	No
	A304, 3A	30	10.4 (35%)	2–4	No	0	No
	A406, 2A	30?	7.0 (23%)	2–10	No	0	Yes (1?)
B	A200, 1A	54	9.7 (18%)	5–8	Central axis	3	Yes (2)
	A301, 3B	40?	8.5 (21%)	6–10	Central axis	2	Yes (2)
	A302, 3A	27	10.0 (37%)	6–10	Central axis	4	Yes (1)/No

Table 15.2 *Area and degree of preservation of occupation deposits and structural features in buildings.*[2] *A406 had a wall-bench in the southern side aisle with a possible counterpart in the northern aisle. A302 had a wall-bench in the northern side aisle in its early phase but not in the later phase. For the two areas of activity of SP I an area is measured for the two contexts with the largest concentration of finds: AL79606 on Plot 1A and AL100381 on Plot 3A/B. No degree of preservation can be given for these layers because there is no evidence of their original extent.*

visitors from Frisian/Frankish lands and the southern Baltic coast was substantial.

Plot 3A/B has far fewer finds than Plot 1A, probably because, as already noted, it was built upon rather sooner, so that the phase of open-air activity (SP I) was shorter. This is probably the reason why the range of activity that can be identified with any confidence is also much narrower: really only domestic activity. The two sherds of pottery from Plot 3A/B fall into the same pattern as the finds from Plot 1A, both being of Slavonic grey Ware, one of them of the Feldberg type. There are otherwise no further features in the range of finds from this plot that would contradict the view of activity in the earliest phase at Kaupang that one can construct on the basis of the finds from Plot 1A.

15.3 The activities of settlers in the early 9th century (SP II)

15.3.1 Two groups of buildings

The available evidence for the function of the buildings is their form and furnishing, the composition of the occupation deposits, the nature of the hearth, and small finds that can be linked to the use of the buildings. The basis on which the composition of the occupation deposits can be interpreted is clearly best in the case of the four buildings in which micromorphological analysis was carried out (Plots 3A and 3B, buildings A301, A302, A303 and A304). The comparison of layer-descriptions produced in the course of the excavations with the results of the micromorphological studies shows that the former do not always pick up crucial aspects of the composition of the deposits. In the case of occupation deposits, such comparisons show that one can usually rely upon the descriptions produced in the field when they refer to the presence of charcoal, ash and sand, but not for the relative preponderances of these components within the layers, nor for the presence of humus (Milek and French 2007:335–52).

Table 15.2 shows that buildings A200, A301 and A302 have several structural features in common, and that these features distinguish them reasonably clearly from the other three buildings, A303, A304 and A406. The latter three also share a number of common features but nonetheless appear less uniform as a group. These two groups of buildings, which will be referred to as Groups A and B, also differ between themselves in the thickness of the occupation deposits, which is consistently greater in Group B. In the case of Plots 3A and 3B, these differences are quite clear in the drawing of the section along the plot (Milek and French 2007:fig. 15.15–16).[3] Is it possible, then, to interpret the differ-

2 The following layers are regarded as occupation deposits: **SP I, Plot 1A:** AL79606, AL79850, AL85079, AL88843, AL89949 & AL96267. **SP I, Plot 3A/B:** AL100381, AL100887, AL100925 & AL101097. **A200:** AL63382, AL61670, AL1022171, AL61643 & AL24500. **A301:** AL62023, AL61151, AL70696, AL66085, AL64192, AL62068, AL65556, AL71681, AL70806, AL65945, AL65923, AL62110, AL64559, AL64701, AL64517, AL47045 & AL46869. **A302:** AL67217, AL68717, AL76555, AL76661, AL77601, AL77718, AL78005, AL78225, AL78352 & AL78497. **A303:** AL81762, AL64713, AL66069, AL86484, AL85221, AL70681 & AL94476. **A304:** AL82178, AL89480, AL85299, AL91483, AL83768 & AL83707. **A406:** AL68378, AL69242 & AL71709.

3 In the drawings referred to here, the occupation deposits in buildings A301 and A302 are the dark grey layers, and those in A303 and A304 are the lighter grey layers below.

ence between these two groups in the thickness of the occupation deposits as a reflection of consistent differences in the intensity or duration of use of the buildings?

Such a line of argument is not without problems. Both micromorphological analysis and the investigation of the fill from pits and the harbour bed show that occupation deposits were cleared out of the buildings on several occasions while the buildings were in use (Barrett et al. 2007:297–300; Milek and French 2007:340, 357). After they had been abandoned, the occupation deposits in all of the buildings were truncated to a greater or lesser degree during the levelling of the plot prior to the construction of the next building. The remains left in some of the buildings have also been damaged by ploughing after the abandonment of the whole town.

These three factors, however, can hardly have produced the systematic difference in the thickness of occupation deposits between the two groups of buildings. One would expect the first two factors to have affected all buildings pretty much equally, and certainly not to have produced consistent contrasts. The third factor, ploughing, affected the three buildings of Group B, which have the thickest occupation deposits, so that this should have reduced the difference between the groups rather than amplifying it. The systematic and conspicuous differences in the thickness of occupation deposits are probably, therefore, due to differences in the length or intensity of use of the buildings.

In the case of four of the buildings, the internal chronological sequence is clear. On Plots 3A and 3B buildings A302 and A301 succeeded A304 and A303 respectively. Do the final two buildings in each group, A200 and A406, follow the same phasing so that one could state that the buildings of Group A were, on the whole, constructed and used before those of Group B?

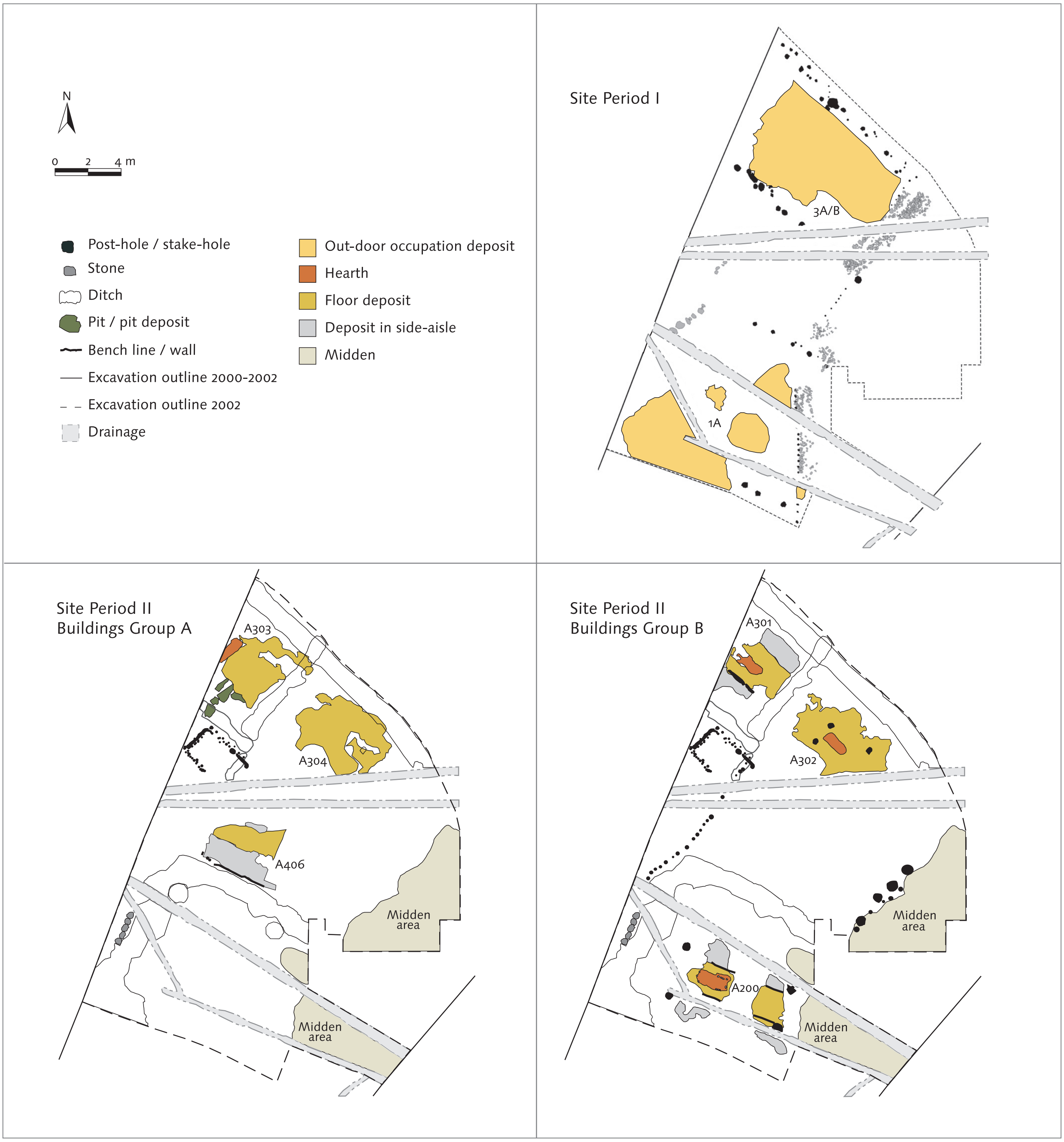
There are a number of points in support of this view. Plot 1A, where building A200 is situated, is the only plot with clear signs of activity in SP I, which means before any building was raised on the plot (above, 401). Traces of production of the same type of beads were found in building A304 on Plot 3A. The manufacture of this type of beads came to an end shortly after the foundation of Kaupang (Wiker, in prep.), and the difference in date between the productive activity on the two plots cannot have been any more than a few years. In addition, the quantity of finds from SP I on Plot 1A was great – 384 entries in the database – while the finds from SP I on Plots 3A and 3B together were much fewer: only 71 entries in the database. The realistic conclusion is that Plot 1A remained unbuilt upon longer than Plot 3A, and that building A200 was therefore built later than the first buildings raised on the other three plots: the buildings of Group A.

Figure 15.2 *The occupation deposits and constructional features of SP I and SP II. From the details summarized in Table 15.2 the six buildings of SP II can be divided into Groups A and B. Map, Hilde Frydenberg.*

On Plot 2A, it appears that building A406 was an early construction, and that it was in use only for a relatively short time. Above the remains of the building there were several layers of detritus which show that the plot remained unbuilt upon while there were buildings on the adjacent plots to the north and the south (Pedersen and Pilø 2007:186, fig. 9.2).

It thus seems clear that the two groups of buildings represent different chronological stages in the development of settlement at Kaupang within the first half of the 9th century. There may have been some overlap in the functioning lives of the buildings of the two groups, but on the whole the buildings of Group A were constructed and used earlier than those of Group B. From here on, consequently, the two groups of buildings will be examined separately, with a view to a concluding comparison between them. From the thickness of the occupation deposits and the dating evidence for SP II, the buildings of Group B were apparently raised in the 820s while those of Group A had been built in the first or second decade of the 9th century.

Because of the site topography, the buildings lie in a fan pattern with their gable ends facing the shore. The alignment of their long axes ranges from WNW to NW. In order to designate the various parts of the buildings, I shall use the terms "lower" and "upper" parts for the halves of the buildings closer to and further from the shore respectively. In order to distinguish between the two sides of the long axis of the buildings, I refer to the "northern" and "southern" parts, even though what is called the northern part strictly lies to the NNE on Plot 1A and to the NE on Plot 3A.



15.3.2 The buildings of Group A

Metalcasting and weaving (Building A303 on Plot 3B, SP II:1)

The first building on Plot 3B may have been built seven years after the beginning of activity on this plot (Milek and French 2007:330) – which presumably means in the first decade of the 9th century. Occupation deposits, a hearth and some other layers have been identified as pertaining to this building. Only the lower 4 m or so of the building were excavated as the upper part continued outside the area of excavation (Fig. 15.1; Pilø 2007d:208–9). The length of this building is thus uncertain. Assuming that the hearth was equidistant from the two long walls, its width must have been about the same as that of its successor, A301, at c. 4.8 m.

As with the approximately contemporary building A304 on the neighbouring plot, 3A, the occupation deposits produced no traces of any functional

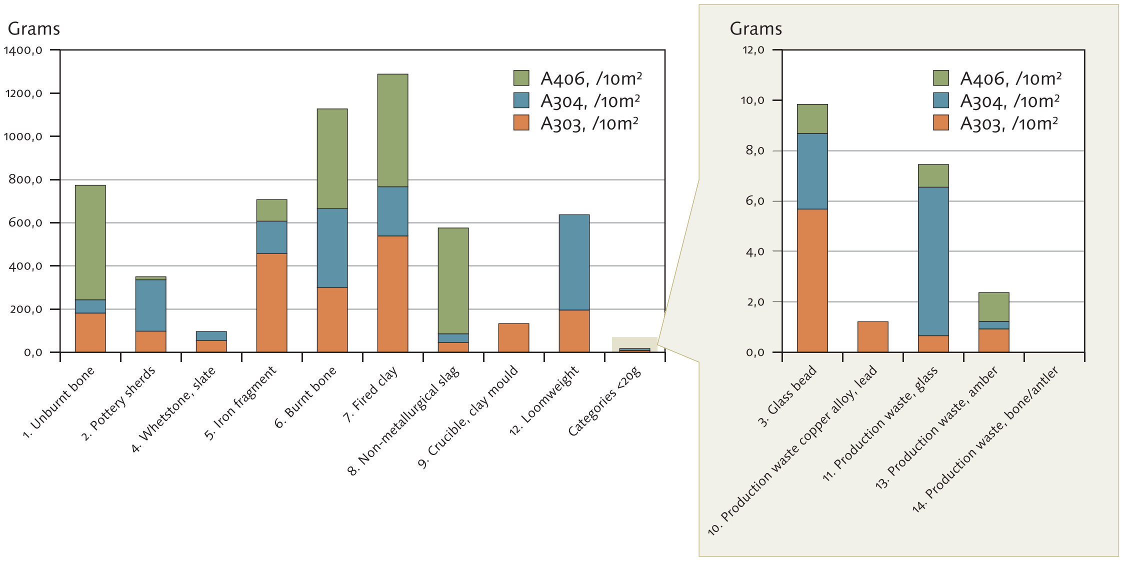


Figure 15.3 *Cumulative bar diagram of the quantities of finds per 10 sq m in the buildings of Group A: A303 on Plot 3B, A304 on Plot 3A and A406 on Plot 2A. Categories of finds weighing less than 20 g are presented altogether in the bar on the far right of the main diagram, and separately in the special chart to the right.*

difference between the central aisle and side aisle nor of any form of interior division. Unlike all the other buildings with hearths examined, A303 had a hearth lying lengthways across the long axis of the building. This unusual disposition must have had something to do with the organization of space within the building. The three micromorphological samples from this building were taken some distance below the hearth along a line crossing the long axis of the building (Milek and French 2007:335–7, fig. 15.5). There was a high proportion of charcoal (10–50%), which agrees well with the presence of a permanent hearth in the building.

The hearth is of a type that would have been used for heating and cooking. Along with sufficient amounts of pottery and both burnt and unburnt bone (Fig. 15.3), the hearth shows that domestic activities were carried out in this building. The quantity of glass beads is high in comparison with other buildings in this group, but since there are only a couple of pieces of glass-beadmaking waste these beads too should most reasonably be regarded as evidence of domestic activity. The same goes for the fragment of a glass beaker. The crossing alignment of the hearth may be the result of a desire to create more space for craft-activity in the upper part of the building.

The other activity for which there is clear evidence in the occupation deposits from this building is metalcasting. The large amount of material in find-category 9 (Fig. 15.3) includes two pieces of a mould of fired clay and two complete and several fragments of crucibles. Find-category 10 comprises one piece of lead casting waste. Alongside the finds counted in Figure 15.3, the occupation deposits included a soapstone mould, weighing about 1 kg, for five types of ingot (C52519/23426; Pedersen, in prep.), three sharpening stones weighing from just 100 g to 2 kg (C52519/27518, C52519/28234 and C52519/27521) and several whetstones. The number of whetstones is higher than in other buildings of Group A. Sharpening stones and whetstones are not uncommonly found in association with casting, having probably been used for sharpening edged tools used in the casting process (Pedersen, in prep.). Fired clay is also well in evidence, and although the amount of non-metallurgical slag is relatively small one can conclude that metalcasting was practised in this building. The small amount of slag may mean that the furnace was situated in the unexcavated upper part of the building.

Although the number of loomweights present is only half that of the neighbouring building (A304), it is greater than in any of the three buildings of Group B (0.20 kg per 10 sq m as opposed to 0.11–0.16 kg), all of which had thicker occupation deposits and were in longer use (Figs. 15.3–4). Weaving can therefore also be counted as a well-documented activity in this building. There was also some sign of amber-working, but not enough to conclude with certainty that this activity took place in the building. The quantity of iron fragments is higher than in any other building of this group; the only pieces that can be identified to type are a few nails. The iron could mean that the furnace in this building was also used for ironworking, but it might equally be associated with other activities.

The building produced evidence of domestic activities, and the finds show that metalcasting and weaving were practised here. The signs of the latter two activities are clear, and indeed diverse in the case of metalcasting, so that both of them must have been carried on at considerable intensity or length. The central hearth shows that domestic activities were more important than in other buildings of this group (see below), and renders the building suitable for permanent occupation. Nevertheless there is no sign of the division into an area of activity in the central aisle and sitting/sleeping areas in the side aisles that is characteristic of houses whose residential function was fundamental. Altogether it does appear most probable that this building served as a year-round house, but it is also possible that periods of residence were only periodical, possibly seasonal.

Weaving and beadmaking (Building A304 on Plot 3A, SP II:1)

A304 was the first building to be raised on Plot 3A. This took place some time in the first two decades of the 9th century, probably not long after AD 800. No structural features of the building were found; only an internal occupation deposit that was identified through micromorphological analysis (Milek and French 2007:344–6; Pilø 2007d:207). This building had no surviving remains of a hearth nor any differences in the occupation deposits that might reveal functional differentiation between central and side aisles. In size, this building was almost exactly the same as its successor on this plot, A302 (Fig. 15.1; Tab. 15.2).

The finds in this building show that it did house domestic activities. The amount of pottery is the highest amongst the buildings of Group A. Be it from cooking pots or containers, the pottery is evidence of domestic life here. Burnt bone occurs at about the same frequency as in the other two buildings. Unburnt bone is less frequent, but differences in the degree of preservation may have affected this. There is also a sherd of a soapstone cauldron with food residue (C52519/26560) and a sherd from a glass beaker (C52519/27625).

These indicators of domestic activity fit poorly with the absence of evidence of a hearth in the building. This absence is also in disharmony with the composition of the occupation deposits in this building, which contain a considerable amount of charcoal and ash (5–10% in the lower part of the building and 20–30% in the middle and upper part: Milek and French 2007:tab. 15.4). The somewhat lower quantity of charcoal/ash than in other buildings (e.g. 10–50% in A303; Milek and French 2007:tab. 15.2) is clearly due to the exceptionally high proportion of organic material in A304 (30–40% in the lower and middle part and 20–30% in the upper, compared with 5–20% in A303), which needs its own explanation (see below). There was proportionately more charcoal and ash in the upper and middle part of the building along with the majority of the burnt bone and fired and unfired clay (Milek and French 2007:tab. 15.4).

The distribution of the charcoal, ash and burnt bone shows that there was a hearth in the middle or upper part of the building. As Wiker writes (in prep.), a low artefact count and high proportion of clay in the occupation deposits in a zone in the middle of a house (Milek and French 2007:345) can show that there had been a hearth here which was removed before the raising of the next building on the spot. If so, this must have been a hearth that was constructed above the floor rather than sunk into it, in constrast to the hearths in the neighbouring building A303 and the buildings of Group B. Since the excavation found occupation deposits covering this zone, such a hearth can only have been in place for some time within the functioning life of the building.

There is definite evidence of craft-activities that required high temperatures. There is no sign of blacksmithing or metalcasting, but, as Figure 15.3 shows, there is much more waste from beadmaking in A304 than in the other two buildings of Group B. The majority of the 17 beads in this building were found concentrated along with beadmaking waste in the middle and lower part. In addition to the quantities shown in Figure 15.3, which comprise 25 objects (as against two in A303 and one in A406), similar glass waste was found in the material used to construct the hearth in the stratigraphically following building, A302. This waste was probably incorporated in that material when the underlying occupation deposits of the previous building, A304, were dug into for the construction of the hearth of A302 (Gaut, this vol. Ch. 9:241). The blue and white beads in question belong to the earliest phase at Kaupang, and this means that the building was in use in the first decades of the town, possibly more or less contemporary with the production of the same type of beads in the open air (SP I) on Plot 1A (see above, 402).

Craftwork needing a high temperature thus was practised within the building. But the occupation deposits produced only small amounts of non-metallurgical slag and rather less fired clay than those of the other buildings of Group A. There cannot, therefore, have been extensive beadmaking requiring the repeated refurbishment of a furnace. It seems rather to have been short-term production.

A lead spindle-whorl (C52519/25197) was found in the building and more than double the quantity of loomweights than in some of the other buildings: c. 0.45 kg per 10 sq m. This shows that textile production was an important activity in this building, possibly the most important craft practised there. Both the spindle-whorl and the great majority of the loomweights were found in the upper part of the building, the latter along the southern long wall, where the loom must have stood.

As noted, the occupation deposits in the lower part of the building contained an unusually high quantity of organic material for Kaupang. Some of this can be identified as bark and worked wood (Milek and French 2007:344–5, tabs. 15.4–5). The building must have had an entrance in the lower gable end, and the most logical interpretation would appear to be that it had a wooden floor or matting of woven branches in the entrance area, as is known from later, similar buildings, of the same construction and layout, found in the excavations in Dublin (Wallace 1992a:35–40; e.g. Wallace 1992b:figs. 103, 105, 114, 138, 139, 140, 145 and 148).

In summary, this building housed textile production, domestic activities, and some glass-bead manufacture. Weaving, spinning and domestic activities were apparently concentrated in the upper part. The distribution of finds, ash, charcoal and clay indicates that there was a temporary hearth in the middle of the building, and there must have been a built-up furnace (see further the discussion of furnaces p. 413, below). The low amount of non-metallurgical slag shows that this furnace was not repeatedly renewed, so that the making of glass beads must have been brief. This, however, is uncertain, as it depends upon how thoroughly the remains of the furnace or furnaces were cleared out. The traces of what seems to have been a wooden floor in the lower part of the building are inconsistent with glass-bead production having been practised here, and this craft must belong to a period when the building had no such floor.

This building shows signs of having served changing uses, with a built-up furnace at one time. At another time it may have had a hearth suitable for the cooking that evidently did take place there. The building could have served as a year-round house while it contained a hearth appropriate for heating and cooking, but this might have only been the case for part of its whole functioning life. The absence of functional differences between the central and side aisles render it more probable that the building was not raised for permanent residence but as a workshop for weaving, glass-bead production, and for short-term occupation, possibly on a seasonal basis.

A smithy? (Building A406 on Plot 2A, SP II:1)

Only some of the occupation deposits in the central aisle and southern side aisle of this building survived. These were both around 1.5 m wide, suggesting that the building was c. 4.5 m across. The composition of the layer in the southern side aisle showed that there had been a sitting and sleeping area here, while the central aisle had a hard-packed floor. This floor-layer was truncated to the north, so that it is impossible to say whether the building had a floor or a wall-bench in the northern side aisle.

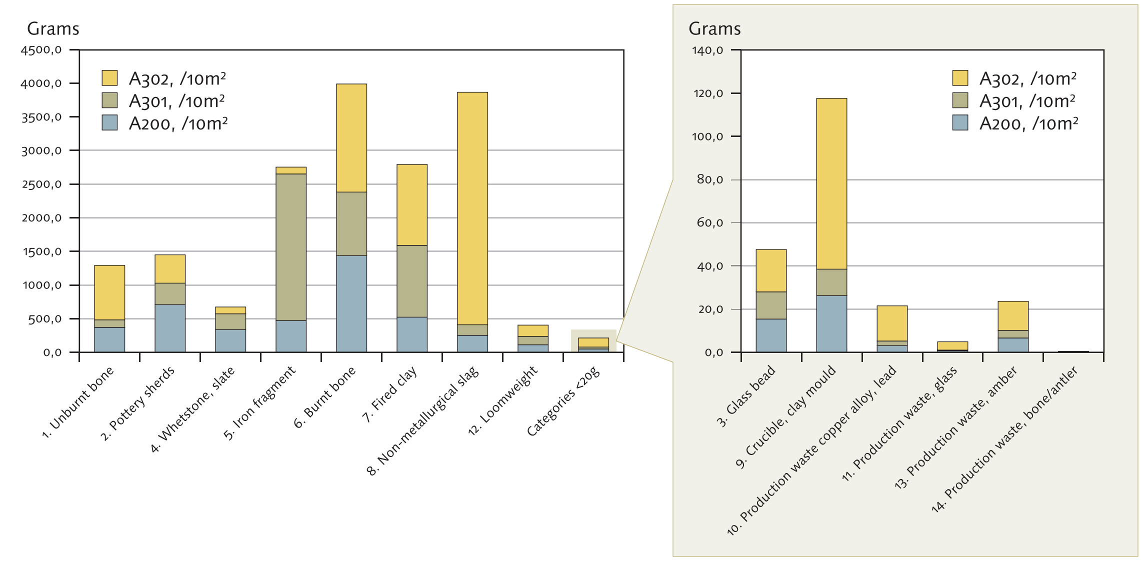
Figure 15.4 *Cumulative bar diagram of the quantities of finds per 10 sq m in the buildings of Group B: A301 on Plot 3B, A302 on Plot 3A and A200 on Plot 1A. Categories of finds weighing less than 100 g are presented altogether in the bar on the far right of the main diagram, and separately in the special chart to the right.*

The occupation deposits were preserved for a maximum of 4 m along the long axis of the building. Probable traces of the southern and western walls were identified. Judging from the distance between the south-western corner of the building and the lower boundary of the plot, the building could at most have been 7 m long. The surviving area is the south-western quarter of the building (Pilø 2007d:206–7, fig. 10.16). No micromorphological analyses of deposits from this building have been undertaken.

There were no remains of a hearth. Although the occupation deposits did not survive in the lower part of the building, a sunken hearth of the same type as, for example, in A200 and A302 on the neighbouring plots would very probably have left its mark. There is a clear tendency for central hearths to be placed as far as possible from the entrance, which must have been in the lower gable end. It seems, then, that this building had no sunken hearth.

The evidence for domestic activities must be regarded as strong, with only pottery in limited quantities (Figs. 15.1 and 15.3): there may be special reasons for this (Skre, this vol. Ch. 16:438). The occupation deposits are rich in burnt and unburnt bone, with a great deal of the latter in the southern side aisle especially. There are also three sherds from glass beakers, two from the same Sherd Family (no. 10) and the other probably cullet for making glass beads (Gaut, this vol. Ch. 9:202, 204).

As in building A304, the absence of a hearth is inconsistent with the composition of the occupation deposits and the finds they contain. They include much fired clay and burnt bone, while the amount



of non-metallurgical slag is the highest amongst the buildings of Group A. The half-kilogram of such slag has probably derived from the demolition of a built-up furnace in the building (see further the discussion of furnaces, p. 413, below). On the other hand there are few if any signs of the craft that could have been carried out using this furnace. There is absolutely no evidence of metalcasting, while the evidence for glass-bead production is minimal. There are few iron fragments too; but in the absence of traces of other activities that would produce non-metallurgical slag ironworking still seems the most probable activity involving the furnace in this building. Smithing does not necessarily produce waste iron fragments, only hammerscale that can be discovered with difficulty, e.g. through the micromorphological examination of the occupation deposits. Such techniques were not applied. One unfinished amber bead and several fragments of amber, one of which shows working marks, show that amberworking was carried out here too. This must, however, have been on a small scale. There are no other signs of craft-activity in this building.

As in A304, with the uncertainty concerning the form of the hearth, it is difficult to determine whether this building served as permanent housing. Although the finds include clear indications of domestic activities, those could represent temporary periods of occupation. Considered along with the form of the building, the finds and the composition of the occupation deposits do not provide clear evidence that it had any long-term or permanent residents.

15.3.3 The buildings of Group B

A house (Building A200 on Plot 1A, SP II)

This building measured around 6 m across and 9 m – possibly as much as 11 m – in length. This makes it the largest building discovered at Kaupang. Ploughing and drainage ditches had damaged the uppermost layers of the hearth and occupation deposits, in places removing the latter. Four postholes, two grooves or partition planks between the central and side aisles, and clear differences in the occupation deposits on either side of the grooves, nevertheless provide a firm basis for planning the internal organization of the building. The central aisle and both the side aisles were around 2 m across, and the side aisles served as a sleeping and sitting area. The fire lies along the long axis, as in A302 off-centre towards the upper part of the building. The entrance was probably in the eastern gable end. No micromorphological analysis of the occupation deposits in this building has been undertaken.

There are clear indicators of domestic activity in the form of appropriate quantities of pottery and both burnt and unburnt bone (Fig. 15.4), together with one sherd from a glass beaker (C52519/10210). The hearth was suitable for cooking and heating. This agrees well with the description of the occupation deposits from this building, which contained much charcoal.

There is little evidence of other activities in this building. The quantity of finds in find-category 9 is not insignificant, but other evidence of metalcasting (find-categories 8 and 10) occurs only in limited quantities. Production waste indicates that amberworking was practised to some extent, an impression reinforced by the fact that three of the six amber beads from this building are unfinished or flawed (Resi, this vol. Ch. 6:110). One spindle-whorl of fired clay is evidence of spinning but, as in the other buildings of Group B, the number of loomweights found is so low that textile production can hardly have been at a level to meet more than the household's own needs.

Thus, although there are indications of craft-activity within the building, they are not prominent, and the conclusion is that this building primarily housed domestic activities. Along with the form of hearth, the internal organization of the building and the thickness of the occupation deposits, that evidence clearly implies that the building was for long-term or permanent residence.

A house and metalcaster's workshop (Building A302 on Plot 3A, SP II:2)

This building was 4.3 m wide and 6.3 m long (27 sq m), and the upper metre of the building was probably a separate chamber, possibly a store-room, leaving a main chamber of some 23 sq m. To begin with it would appear that this main chamber had a northern side aisle for sitting and sleeping in. This was altered during the life of the building, however, and in a later phase there is no evidence of such a division. Post-holes from two pairs of roof-bearing posts, with three of the four having survived, are probably to be associated with this building. Where the fourth post ought to have been, there is a more recent drainage ditch which seems to have removed the post-hole. Throughout the functioning life of the building the main chamber had a central hearth of the same kind as in A200 and A301. This hearth lay along the long axis of the building, slightly off-centre towards the upper end, and about a metre from the partition wall to the store-room (Milek and French 2007:347–52; Pilø 2007d:207–8).

The form of the hearth suggests that the building housed domestic activities, and this is corroborated by the composition of the occupation deposits and the finds there. Micromorphological analysis revealed a high quantity of charcoal and lenses of waste from food-preparation (Milek and French 2007:348). The quantities of pottery and both burnt and unburnt bone in the occupation deposits are consistent with the other buildings of Group B (Fig. 15.4). The occupation deposits also included four sherds of soapstone vessels and a piece of Rhenish basalt quernstone. The basalt fragment (C52519/27618) is the only one found inside a building at Kaupang, and one of just two from stratified contexts. Further evidence of domestic activities comes in the form of four sherds of funnel-shaped and cylindrical glass beakers (Sherd Families 5, 5? and 12?; C52519/20997, /21524, /21045, /40322), which apparently derive from glassware used and broken within the building (Gaut, this vol. Ch. 9:Fig. 9.29, Tab. 9.9).

The finds from the house show that metalcasting was carried out (Pedersen, in prep.). There are 3.5 kg of non-metallurgical slag per 10 sq m, fourteen times more than in any other building of Group B, and seven times more than in A406, which has the highest density in Group A. The quantities of crucibles, moulds and production-waste here are also the highest in Group B and at the upper end of the range of all the buildings investigated. Pedersen (in prep.) identifies melt-drops from two distinct copper alloys in the building, and the crucibles testify to the melting of both silver and copper alloy. The occupation deposits also included a fragment of a soapstone tuyère, the only example found inside a building at Kaupang (Baug, this vol. Ch. 12:322). A sharpening stone weighing 14 kg may have been used for sharpening metalcasting tools (C52519/28235). In the earliest occupation deposits from this building there was a cylindrical lead weight of 5.03 g (C52519/24586; Pedersen 2008:130, 158 and 190–1). Unlike the weight in A301, this was found in association with metalcasting rather than with items connected to payment, and its presence is therefore very probably because it was itself cast, not used in transactions, within this building.

The composition of the occupation deposits shows that the metalworking in this building was not merely a one-off event, as the non-metallurgical slag appears in unusual quantities from the earliest floor layers to the latest. In the first phase of the building, however, there is much less in the northern side aisle, which was presumably, therefore, a sitting and sleeping zone as in several other buildings (Pilø 2007d:207). The evidence of metalcasting was found mostly in the lower part of the building, below the hearth. This holds equally for non-metallurgical slag, casting waste in copper alloy, mould-fragments, crucibles, the sharpening stone, and the tuyère-fragment. The casting thus apparently was carried out in this part of the building. Since no traces of a furnace have been found *in situ*, it was presumably built up (see further the discussion of furnaces p. 413, below).

The other craft of which there is evidence in this building, textile production, was also practised in the lower part, unlike in the previous building on this plot, A304, where weaving was carried out in the upper part. A sandstone spindle-whorl (C52519/19412) was found in the lower northern corner, and the lower part of the building also produced the majority of the loomweights – which were present in quantities equal to the other buildings of Group B. Compared with A304, the evidence of weaving is much less, and this craft cannot have been pursued to anything like the same extent as in A304.

The interior arrangement of this building would fit with it having served as a workshop as well as a house. It would appear that domestic activities were associated with the northern side aisle in its first phase but were focused upon the hearth in the upper part of the building in its later phase. Sherds of pottery were found throughout the building, albeit with a clear tendency to concentrate in the upper part. The central hearth was situated close to the upper end of the main chamber, only some half-a-metre from the partition wall and 1.5 m from the end of the building. This location left a large open floor-space, c. 4.3 m x 4.0, in the lower part of the main chamber, where the incident light from the door was strongest. Compared with the pair of roof-bearing posts in the upper part of the building, the posts in the lower part were placed further out towards the long walls of the building. This helped to open up a larger floor-area in the middle of the lower part of the building, which would have been particularly well suited as a work area.

The building produced clear signs of residential occupation. Along with the type of hearth, the interior organization of the building and the thickness of the occupation layers, that evidence clearly indicates that the building had long-term or permanent residents. The remains of metalcasting are very prominent here, but still fall behind those found on Plot 1B (Pedersen, in prep.). On that plot, no remains of the building itself were excavated, only layers of waste at the bottom end of the plot, probably on the lower side of the building. No such layers of waste survived outside building A302, and it is difficult, as a result, to compare the quantities of finds with one another. The large quantity of finds on Plot 1B may nonetheless show that the metalcasting in building A302 was not as intense or as long-lasting as that on Plot 1B. The primary function of A302 may have been as a dwelling.

The Frisian merchant's house (Building A301 on Plot 3B, SP II:2)

This building was 4.8 m wide and its lower part was excavated to a length of 4 m. The upper part lay outside the MRE area. The adjacent CRM excavation revealed two post-holes that are probably from this building. From the lower gable end to the post-holes measures about 6 m, and the positioning of posts in other buildings suggests that the full length of the building was at least 7 m. Although some of the occupation deposits had been removed by ploughing (Milek and French 2007:340), these were preserved to a thickness of up to 10 cm (Pilø 2007d:209). In the surviving part of the building the composition of the occupation deposits showed a very clear functional distinction between an area one could walk around in a central aisle 2.4 m wide and a sitting and sleeping area in two side aisles of 1.2 m. The central aisle thus accounted for about half the floor-area while in the other building with two side aisles (A200) it is only about one-third. In the two buildings where there is evidence of a sleeping and sitting space in only one side aisle (A302 and A406), the central area likewise accounted for only a third of the area of the building. A301 is thus quite different in the way the floor-space was apportioned between the central and side aisles.

The hearth, which was placed on the long axis of the building and measured fully 1.7 m x 0.8, was situated 1.5 m from the lower gable end: the same distance as the hearth in A302, on Plot 3A, from the upper gable end. The hearth in A200 was probably about the same distance from the upper gable end. The fire seems consistently to have been positioned closer to the gable end that did not have the entrance door.

Samples for micromorphological analysis of the occupation deposits were taken along a line across the long axis of the building through the centre of the hearth (Milek and French 2007:fig. 15.7). These therefore represent the activities around the hearth and demonstrated, as expected, typical evidence of food-preparation and consumption (Milek and French 2007:341–3).

A concentration of Frankish metalwork in the building strongly indicates that at least one of the residents was of Frankish/Frisian origin (Wamers, this vol. Ch. 4:78–9, 89–90; Skre, this vol. Ch. 16:431–2). The only craft that would appear to have been practised in this building was weaving. Loomweights were found in the same quantities as in the two other buildings of Group B, and as in those the numbers are relatively small so that production was perhaps limited to immediate domestic use. Some waste from amberworking was found in the building, together with one raw piece and two beads, but the quantities are so small that they could be intrusive or represent very small-scale activity. However, only the southern part of this building has been excavated. As shown in the neighbouring building A302, there may have been differences in activity in various parts of the building, so that craft-activity could have been carried out in the upper part that is only weakly reflected in the finds from the excavated lower part.

The earliest firm evidence of the use of silver as currency in the form of hacksilver and weights appears at the end of SP II (Hårdh 2008:114; Pedersen 2008:130). Of six pieces of hacksilver from SP II, four were found on Plot 3B and the two others on the neighbouring plots to the north and south, 4B and 2B. Three of the four pieces of silver from Plot 3B lay together in the southern part of the plot, in the area south of the southern wall-bench in A301, and two lead weights were found in the same area. In precisely the same area, the overlying medieval plough-layer contained three further pieces of hacksilver, two coins and a weight (Pedersen 2008:162, fig. 6.29). As noted, the evidence for metalcasting in A301 is so slight that the silver and weights can hardly be associated with any such activity.

Group	Building, Plot	Permanently occupied?	Identified activities						
			Domestic	Textile production	Metal-casting	Glass-bead production	Ironworking/ Blacksmithing	Amber-working	Trade
SP I	1A	No	Primary		Primary	Primary	Secondary	Secondary	
	3A/B	No	Primary						
A	A303, 3B	Yes?	Primary	Primary	Primary			Secondary	
	A304, 3A	No?	Primary	Primary		Primary		Secondary	
	A406, 2A	No?	Primary				Secondary		
B	A200, 1A	Yes	Primary	Secondary				Secondary	
	A301, 3B	Yes	Primary	Secondary					Primary
	A302, 3A	Yes	Primary	Secondary	Primary				

Primary activity

Secondary activity

Table 15.3 *Activities identified on the plots of SP I and in the buildings of Groups A and B of SP II. Activities identified as "primary" left substantial traces in the building. Activities marked as "secondary" are identified only through faint traces, not always certain.*

One of the four pieces of hacksilver from Plot 3B in SP II is from an occupation deposit in building A301. This a fragment of a spiral-striated rod weighing 1.3 g (C52519/17264; Hårdh 2008:108, fig. 8.10), a type of ring that was probably made in south-western Scandinavia from the second quarter of the 9th century onwards for use in payment (Skre 2008d:349–50). The three other pieces of currency silver from Plot 3B in SP II (C52519/19670, /19686, /22446) are less securely associated with the building, as is the case with those from the same area in the overlying ploughsoil. Some of the earth in this plough-layer, however, was redeposited from the occupation deposits of A301 (see above), and the functional connexion between the weight and the hacksilver that were found together in the southern wall-bench of A301 supports the idea that there is some link between the concentration of silver and weights in the intact layers of A301 and in the overlying layer. How many of these weights and pieces of hacksilver derive from activity in A301 itself cannot be decided, but the occurrence of both types of object in a secure context in A301, together with the strong concentration in such a small area in soil deposits that probably derive from the same wall-bench, renders it probable that many of those should be attributed to this building.

The residents of building A301 thus kept and used currency. Together with the lack of evidence for craft in this building, the presence of at least one Frankish/Frisian member of the household suggests that these were Frisian merchants (see further the discussion in Skre, this vol. Ch. 16:431–2). This may be the reason why silver was used as currency very early in building A301. Franks and Frisians would have been familiar with the use of silver, and probably used Carolingian coins to a limited degree in Kaupang in the first half of the 9th century (Skre 2008d:347–8). They probably traded with people from silver-using areas along the southern coasts of the North Sea. They, then, may have been instrumental in the adoption of hacksilver at Kaupang.

15.4 Activities and buildings in SP I–II

Tables 15.3–4 summarize the chronological and spatial plan of the activities just identified. As can be seen in Table 15.3, there are some very clear differences and similarities between the various units analysed, not only between the two open plots of SP I but also amongst the buildings of SP II. There are also differences between the open plots (SP I) and the groups of buildings.

In the following discussion of these differences and similarities, an attempt will be made to distinguish between what may be identified as general trends, detectable over much of the settlement area, and changes in use of this particular part of the town. The latter may also include some differences and changes that cannot be identified in the rest of the finds.

15.4.1 Continuity of activities

As Table 15.3 shows, there is practically complete congruency in the types of activities that can be identified in SP I and the buildings of Group A respectively. One difference is that there is no evidence of textile production in SP I; a fact obviously due to the difficulty of weaving in temporary shelters during quite short periods of occupation. The conclusion is therefore that there was a high degree of continuity from SP I to SP II in terms of the craft activities identified by this study.

The differences between Groups A and B are greater. In Group A, textile production was a significant craft in two buildings, while in Group B it is only limited in scope but is present in all the buildings. Group A also shows glass-bead production and possibly blacksmithing, unlike Group B. As Wiker (in prep.) shows, the glass beads were manufactured at Kaupang in the very early 9th century, after which there appears to be a break before production started again shortly after c. 850. The absence of this activity in Group B may well be because no such production was taking place in Kaupang during the time in which these buildings were used, or only at a very low level.

The evidence for blacksmithing in Group A is uncertain, so therefore too much weight should not be put on the fact that there is no sign of this activity in Group B. North of the laid-out plots of the settlement large quantities of slag have been found, and Pilø (2007c:170–2) has concluded that blacksmithing was carried out here, probably in order to reduce the risk of fire in the closely packed settlement. The presence of the equally dangerous craft of metal-casting in Group B (A302) shows that the assumed relocation of all activities with a fire-risk was in any event not total in the second quarter of the 9th century.

One activity, trade, can be recognized in Group B but no earlier. This difference is very likely due to the limited possibility of identifying this activity at all. Its identification in Group B is due to the presence of the new forms of currency introduced in the second quarter of the 9th century, hacksilver and the associated weights (Hårdh 2008; Pedersen 2008:130–1 and 162; Skre 2008d:348–51). These means of payment appear in relatively large quantities, and the likelihood of them being found in the buildings' occupation deposits is therefore greater than earlier in the century. The presence of what were evidently traded goods as early as SP I shows that trade did take place at Kaupang from the very beginning (Skre, this vol. Ch. 16:425–30).

15.4.2 Workshops and houses

Another difference between Groups A and B lies in the number of activities, other than the domestic, identified in each building. In two of the three buildings of Group A three different activities have been identified, while in each of the buildings of Group B there is only one activity identified. As noted, the representation of textile production in Group B is so limited that this has to be counted as a domestic activity. The extent or intensity of the activities is also different between these two groups. Two of the three buildings of Group A have prominent traces of at least two different crafts, but only one building in Group B has any such evidence, and this building was subject to comprehensive reorganization, perhaps after it was occupied by new residents. These differences cannot be attributed to different functioning periods for the buildings in Groups A and B respectively, as the thickness of the occupation deposits and the dating of the finds indicates that the buildings of Group B remained in use for longer periods than those of Group A. How then might these differences in the range of activities be interpreted?

The reason for this difference most probably lies in the way the buildings were used. As the discussion of the buildings of Group A, summarized in Table 15.3, implies, there is real doubt as to whether any of these buildings were in use on a whole-year basis. This is because only one of them, A303, had a permanent hearth that would have served for heating in winter. This building, however, had no functional zoning between the central aisles and side aisles such as is typical of buildings which were primarily residential. However the evidence for year-round occupation is very clear in the case of all three buildings of Group B.

The sensible conclusion is that the range of activities in the buildings of Group A is because each of these buildings throughout its lifetime had varying groups of occupants. Along with the absence of signs of year-round occupation, this leads to the inference that the buildings of Group A were workshops in which people normally lived only on a seasonal basis – perhaps with occasional over-wintering.

One very well-preserved workshop of the early 11th century from the medieval town of Viborg in Jutland (Iversen et al. 2005) may help understand the Kaupang buildings. In this workshop, which measured 3 m x 5, metalcasting and smithing had been practised. The building had unplastered wattle walls and roof-bearing posts in the wall. The excavators argue that the walls did not reach right up to the roof, thus allowing light into the building and smoke out (Thomsen 2005:277, fig. 18).

Up against the northern shorter wall of the building was the built-up base of a furnace, measuring 1 m square and about 0.3 m above the floor level if not higher. It consisted of a wooden box filled with sand (Thomsen 2005:281). Built-up furnace bases of this kind were apparently uncommon in Viking-period Denmark but are rather well-known from the 13th century and later. In the Viking Period the furnaces were usually constructed in a pit in the ground (Jouttijärvi et al. 2005:297). Nevertheless, the discovery in Viborg reveals a built-up furnace from the early 11th century. That no such finds have been identified earlier must be because there is hardly any pictorial evidence from before the High Middle Ages and because such an exceptionally good state of preservation as that in Viborg is extremely rare. Therefore, the possibility must be kept open that built-up furnaces were around in the Early Viking

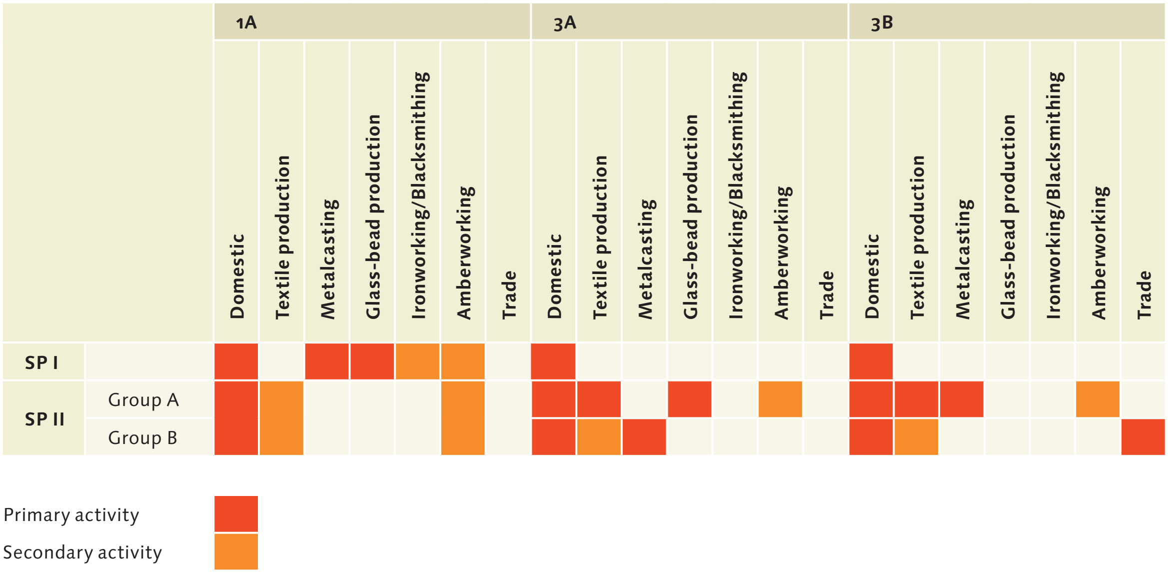


Table 15.4 *Continuity and discontinuity in the activities identified on Plots 1A, 3A and 3B from SP I and through SP II. Plot 2A is omitted because only one period has been identified in which occupation deposits accumulated there (A406 in Group A). Plot 1A had no building of Group A, so that the activity-profile in the building of Group B (A200) makes up the entirety of SP II.*

Period too, and the analysis of the floor-layers from three buildings in Kaupang (A302, A304 and A406) suggests that this was indeed the case.

The workshop in Viborg was built in the year 1019 and was then used for short periods and with several breaks to the year 1025. The crafts practised there varied, including blacksmithing, metalcasting and combmaking. The craftsmen probably lived in another building on the plot or in the vicinity. This agrees with the fact that no signs of the preparation or consumption of food have been found in the workshop (Jouttijärvi et al. 2005:307). The discontinuity of activity in the workshop, and the fact that it housed several different crafts, imply that it was not the possession of one particular artisan. It seems more likely that this and the other workshops, which were found in the area, were in the ownership of whoever their goods were produced for, probably the king (Hermand et al. 2005). The connexion between periodical use and discontinuity in the personnel who used the plots and buildings would appear clear in the case of Viborg, and the same must hold for the buildings of Group A at Kaupang.

The functional lives of the buildings of Group A are longer than the functional period of the plots of SP I, but the range of activities within the buildings is nevertheless narrower. It would thus appear that continuity in use within the buildings of Group A was greater than that on the open plots of SP I. This could either be due to the fact that the buildings had fixed interior arrangements that rendered them more suited to some crafts than to others, or because it was individual craftsmen who raised the buildings and so secured for themselves a preferential right to use them the following year – if indeed they came back.

Remains of textile production in two of the buildings of Group A and all of those of Group B shows that women lived and worked in the houses throughout SP II. It is improbable that women travelled unguarded by men, and some of the groups of craftsfolk who appear to have used the buildings of Group A for short periods were therefore probably family units. One family would appear to have lived in each of the buildings that were permanent houses.

The fact that the range of activities in each of the buildings of Group B is even narrower than that of Group A must imply that year-round occupation meant markedly greater continuity in the residents of each house. In addition, though, it appears that the town, or perhaps only this part of it, changed in character from being primarily a workshop zone to being a residential area. And, probably connected to that development, there is a clear trend for the crafts requiring heat – and therefore were a fire-risk – to withdraw from this area,. The only craft needing high temperatures for which there is evidence in the three buildings of Group B is the metalcasting in A302. This building is the only one of this group that has only a single side aisle for sitting and sleeping in – and that only in its first phase. This building thus shares characteristics both with the buildings that are more like the workshops of Group A and with the residential buildings that are otherwise characteristic of Group B.

On the basis of Table 15.4 it is possible to assess the continuity and discontinuity in activity on individual plots from SP I to the buildings of Group A and Group B. Overall, there is very little continuity. Consequently there is very little to suggest that those who worked in the buildings of Group A on Plots 3A and 3B were amongst those who had used those same plots in SP I. There is also very little indication that those who used the houses of Group B were amongst those who had worked in the buildings of Group A on the same plots.

There is nothing to suggest that those who practised the crafts in the town lived in one part of the site and worked productively in another. There is evidence of domestic activities in all of the occupation deposits that have been investigated, from the open plots of SP I as well as the buildings of Groups A and B. This shows that the plot and building cannot have been a place of production alone; rather, those who were engaged in production also lived there. One conclusion to draw from this must be that this evidence implies that each group of producers only controlled one plot for the period in which they were at Kaupang.

The transition from a workshop zone to a residential area may have been a local shift only affecting these buildings, or may reflect some change that affected the whole town. It has been shown, however, that crafts requiring heat were also practised within the settlement in the second half of the 9th century and into the 10th century (Pedersen, in prep.; Wiker, in prep.).

The Inhabitants: Origins and Trading Connexions

16

DAGFINN SKRE

In order to try to identify the areas of origin of the inhabitants of Kaupang and the trading contacts of the town, the imported goods in Kaupang are divided into *personal possessions* and *traded goods*. Personal possessions may reveal where the inhabitants had come from when they settled in Kaupang, and the traded goods can show which regions the town had regular trading connexions with.

In the first half of the 9th century, it appears that visitors and settlers came from southern and western Scandinavia, as well as from western Slavonic and Frankish/Frisian regions. The settlers from Frankish regions came mostly from the area between the Seine and the Rhine, and from Frisia, while the Slavonic seem to have come from the coastal lands around Rügen. Many of the Frisians, perhaps also the Slavs, appear to have been craftsmen and traders. In one of the six buildings excavated there was a permanent household of Frankish/Frisian merchants, in another, probably, a Danish household.

Western Slavs were present from the beginning through to the end of the 9th century. However, permanent settlement of western Slavs cannot be demonstrated, and it is possible that they were only present for limited periods. No certain traded goods from western Slavonic regions have been identified.

The trade links with the Frankish/Frisian regions remained comprehensive until the middle of the 9th century. After that date, trading connexions came to an almost complete halt, and there were no further settlers from there.

The trading contacts with the lands bordering the Irish Sea, possibly also Nothern Brittain, seem to have continued throughout Kaupang's history. There is no secure evidence of people originating in these regions having visited or settled in Kaupang, and the finds do not have the same ethnic implications as the Frankish material. It is probable, therefore, that Scandinavians were responsible for the trading contacts with these areas.

Both grave finds and settlement finds show that most of the population of Kaupang was from Scandinavia. Personal equipment shows that in the earlier period these were primarily from the South although there were some from the West too. After c. AD 850 there is an increased ratio of types of jewellery that are common in western Scandinavia, implying that settlers from that quarter were more common amongst the population of the town. Iron may have been one of the trade goods that attracted non-Scandinavian merchants to Kaupang as early as the beginning of the 9th century, but they could also have been after goods that are not represented in the surviving archaeological finds, such as slaves or furs. All of the identifiable trade goods from western Scandinavia may have come from the Opplands – i.e. the interior of eastern Norway – but it is not impossible that goods came from western and northern Norway that we are unable to trace archaeologically.

One of the topics that has been discussed most frequently in studies of the Viking Period is the trade routes of the period (e.g. Arbman 1937; Hatz 1974; Resi 1979; Hodges 1982; Düwel et al. 1985, 1987; Fomin 1990; Christophersen 1991; Callmer 1994; Bäck 1997; Ambrosiani 1999b; Anderton 1999; Steuer et al. 1999; Ambrosiani 2002; Näsman and Roesdahl 2003). The basis for identifying the movements of things has steadily improved as the quantity of archaeological evidence has grown, and methods of excavation and of laboratory analysis have made the dating and provenancing of finds more precise. Advances in analytical theories have also been of great significance, such as Sindbæk's introduction of network theory (2005, 2007). The precision of fundamental concepts has been improved – including the core concepts of "trade" and "exchange" (e.g. Hodges 1982; Brumfiel and Earle 1987; Christophersen 1989; Moreland 2000, 2010; Skre 2000; Gustin 2004; Skre 2008d).

In the Viking Period of Scandinavia, objects are the most important basis for the identification of trade routes. But how are the finds from Kaupang to be made to speak of the trading routes to and from the site? This is the subject of the first subsection (16.1), which will show, amongst other things, that items that came to Kaupang as personal possessions must be distinguished from items that came as traded goods.

This is followed by a review of the various categories of find, with observations on their areas of origin and their interpretative potential (16.2). The two following sections contain the analysis of the data, leading to conclusions both about the trading connexions of Kaupang (16.3) and the places of origin of the inhabitants (16.4). The key points from these discussions are then applied in the overall discussion in Chapter 17.

The graves at Kaupang also contained a number of objects that add information on the issues discussed in this chapter. It is a fair assumption that those who were buried at Kaupang were also inhabitants of the town, or at least had Kaupang as one of their places of residence. Charlotte Blindheim examined the graves at Kaupang in an attempt to identify the areas of origin of the dead, and the results of her studies, together with Stylegar's new review of this material (2007), are applied here.

16.1 The movements of things – some observations

A persistent topic throughout the chapters of Parts I and II of this book has been the dating and provenance of the objects, which has sorted out the evidence for an analysis of where the various items came to Kaupang from, and when, and thus for a discussion of the trading connexions of the town. There are, however, still a few issues that need to be dealt with before such an analysis can be carried out.

16.1.1 Personal possessions and traded goods

A considerable collection of objects found at Kaupang come from areas overseas to the South, West and South-East, while others are from various parts of mainland Scandinavia. These objects made their way here in several different ways, which can, however, be grouped into two principal categories. Firstly, they may have arrived as *personal possessions*: in other words, people who were going to dwell in Kaupang for shorter or longer periods brought them for their personal use. Several types of object that have previously been regarded as trade goods should rather be classified as personal possessions (e.g. Forster 2004; Pilø, this vol. Ch. 10:301). In so far as these items can be traced back to a place of origin, they provide little information on trade routes leading to Kaupang, but rather about where those who settled in Kaupang came from.

The second category comprises objects that may have arrived as *traded goods*: in other words, they were brought to Kaupang for the purpose of exchanging them there. There are very probably mixed cases between these two categories. Objects could have been brought as personal possessions but later have been sold or given away, and trade goods may have remained unsold, and so have been given away or used by those who brought them to the town. Even though both categories could have provided gifts, and trade goods could have become personal possessions and vice versa, this is not significant with regard to the two key questions that will be discussed here. The purpose for which objects were brought to Kaupang is what determines their ability to shed light on where the settlers of Kaupang had come from and what routes the traded goods were travelling.

16.1.2 Import and export

In studies of traded goods, the paired terms "import" and "export" are widely used. Some scholars also distinguish between "local" and "foreign" goods. So, what really is "home" in this regard, and what kinds of *entity* were the goods imported to, or exported from? It appears that these terms are most commonly used with regard to present-day political and cultural boundaries. Thus, when found at Kaupang, whetstones from Telemark and western Norway are "local", while Jutlandic pottery is "foreign" (e.g. Blindheim et al. 1999:29–57).

If, on the other hand, one thinks in terms of the political facts of the early 9th century, when Kaupang would appear to have been a town in the northern periphery of the Danish king's realm (Skre 2008d:354), Danish amber and Jutlandic pottery become "local", while the whetstones from Telemark and the West are the "imports". The finds indicate that the first generation of inhabitants of the town identified themselves more with people from Ribe, Hedeby, Lejre and Uppåkra than with those who came from Avaldsnes in Rogaland, Mære in Trøndelag, or Borg in Lofoten, even though the latter are situated within the borders of what had become the Norwegian kingdom by the end of the Viking Period. On the wharfs and streets of Kaupang in the mid-9th century it may have been more usual to meet Slavs from Rügen than visitors from Ohthere's homelands in Hålogaland.

Nonetheless, it would not make sense to treat goods from areas assumed to have lain in the southern parts of the Danish kingdom as "local". For one thing, no sufficiently precise provenancing of goods can be achieved: for instance we have not undertaken analyses that would allow us to distinguish amber from what, in the relevant period, were Slavonic, Danish or Frisian lands.

A point of greater importance is that the incorporation of Vestfold in the territory of the king of the Danes probably took place in the late 8th century, before which Vestfold had its strongest political and cultural relationships with the immediately neighbouring regions of southern and south-eastern Norway: areas which in the 9th century lay partly within and partly beyond the Danish kingdom. Both in burial practices and building styles, Vestfold's association with the adjacent regions in Viken and along the coast to the West remained strong throughout the Viking Period. This complex and dynamic cultural, economic and political reality cannot be subsumed within the terms "local" and "foreign", and those terms will therefore not be employed in the following discussion.

In light of this view of the circumstances of the town, the only meaningful sense in which "import" can be used is in contradistinction to local production. In this chapter, then, this term denotes goods that were brought into the town. Correspondingly, "exports" refers to goods that were freighted out of the town.

In the ground at Kaupang we have found large quantities of goods that were made in the town, and direct evidence of the processes of production themselves has been discovered. Most of these products would undoubtedly have been sold to visitors who would have taken them elsewhere, presumably normally to where they lived. A mapping of where goods manufactured in Kaupang got to would therefore also contribute to the mapping of the town's trade routes.

This, however, would be an undertaking beset by immense problems. Although in graves and settlements around north-western Europe it should be possible to identify objects of the same type as those produced in Kaupang, it would be extremely difficult to prove that they really were made exactly there rather than anywhere else. It would also be impossible to re-trace the potentially complex movements they followed between production and deposition. And even if it were possible to solve those two problems, it could scarcely be possible to produce figures that form a reliable basis for conclusions; not within the scope of the present project in any event. Consequently the exportation of goods that were made in Kaupang is not discussed below. The importation of raw materials for manufacture, such as glass, lead and bronze, will of course be included in the study.

Amongst the imported items brought into Kaupang with the intention of selling them, three different categories should be distinguished:

1. Consumables, such as, for instance, fuel, foodstuffs and building material. These are goods of low value in relation to their weight and volume, and they were produced in every populated region. They would therefore have been transported only over quite short distances, both by their buyers and their sellers. They would thus normally have come from the immediate vicinity of the town, perhaps from southern Vestfold, and they were mostly intended for the inhabitants of the town. Visitors would have obtained such commodities in the town only for the period they stayed there. In so far as evidence of such goods is preserved, it will be found in the settlement zone.
2. Products that do not occur in most settlement areas in the way that those in category 1, above, do, and which were brought into the town for sale. Both visitors and inhabitants would usually have wanted iron, soapstone vessels and whetstones, and have decked themselves out with oriental beads of glass, cornelian and rock crystal. Some also managed to get access to more exclusive commodities such as wine, spices and honey. Since not only visitors but also the inhabitants of the town would have been consumers of these goods there should be a good chance of encountering them in the settlement area of Kaupang – assuming that the evidence survives.
3. Larger consignments of goods that passed through Kaupang on their way to consumers elsewhere.

The first of these categories is not discussed further here as it is not the aim of this exercise to examine the relationship between Kaupang and its immediate hinterland. The second category accounts for a high proportion of the finds from the settlement and the cemeteries and is that which is considered here in detail.

The third category is more elusive. Axel Christophersen (1991:166–7) suggested that Kaupang was founded as "a staple and transit port" for goods from the valleys of eastern Norway destined for the Danish kingdom – specifically iron, soapstone and whetstones. It seems quite clear, though, that there are practically no whetstones or soapstone vessels from eastern Norway in Ribe, which was abandoned c. AD 850; those items, rather, appear first in greater quantities in Hedeby after the middle of the 9th century (Resi 1990:44–7; Feveile and Jensen 2000:20, fig. 11; Skre 2008d:353; Baug, this vol. Ch. 12). Access to these goods can hardly, then, have been the reason for which the town was established. Iron, however, is undoubtedly a possibility from the very start (below, pp. 432–3), and soapstone and whetstones could have emerged as important transit goods in the second half of the 9th century.

If there were a transit trade in large consignments through Kaupang, it would imply that iron ingots and objects, soapstone vessels and whetstones were transhipped and possibly stored in relatively large quantities at Kaupang before being freighted on to the south. No suitable buildings for storage of this kind have been identified through excavation, but there may have been some outside of the excavated areas. One might expect, though, that warehouses and transhipment places would be detectable in the finds from the surface surveys (Pilø and Skre, this vol. Ch. 2:20–1). Soapstone vessels would have been broken in warehouses and where they were being transhipped; inadequate whetstone blanks would have been discarded there; and it would not be unrealistic to expect one or two iron ingots to have been found. However there are no concentrations of finds like this, and it thus does not appear likely that Kaupang was a transhipment port or collection place for large volumes of goods of this kind (Resi and Alvik 2008:49).

Furthermore, the way in which such possible transit goods were used in Kaupang does not indicate that they were present in large quantities in the town. As Resi writes (this vol. Ch. 14:379, 393), the finds suggest that whetstones were in high demand, and were not of particularly high quality. The closest parallels to the range of whetstones found in Kaupang occur at sites such as Hedeby, Dorestad and York. Thus Kaupang, with regard to whetstones, appears rather to have been a consumer site rather than a transit port, and the same probably applies for soapstone (Baug, this vol. Ch. 12:335).

On the other hand, it is only possible to retrieve some of the potential range of transit goods. Goods of this nature such as walrus-skin rope, furs or slaves will not have left any clear evidence in the stratified deposits at Kaupang. Although, unlike Birka, Kaupang lacks finds of the foot bones of the relevant animals (Wigh 2001:120–3; Barrett et al. 2007), a trade in furs cannot be ruled out. It is conceivable that the practices in preparing fur here were different from those of Birka, where the feet were evidently removed only after the pelt arrived in the town. There is little basis to form any idea of further possible transit goods.

As there is no evidence that it was a feature in Kaupang, genuine transit trade of large consignments of goods will not be counted a possibility in the further discussion. However access to goods that were available in the town, and which were in demand in long-distance trading networks, was a principal reason for traders from overseas to settle in Kaupang. The absence of evidence that such goods came into the town in large quantities shows that these visitors probably obtained their wares through a series of small-scale transactions. Such purchasing could have included all of the forms of goods discussed above, although the surviving evidence allows an assessment of only one of them, iron (below, pp. 432–3).

16.1.3 What is found and what is not

In studies of this kind, one has to take account of the factors that govern what, out of all of the items that were in use in the town or changed hands there, it is possible to retrieve. Before anything else, the conditions for preservation will remove a certain range of materials. Secondly, it is almost only small objects and fragments of larger items that have remained in the ground. And thirdly, people would have taken much better care of small items of value than of objects of less value. To put it in a nutshell: what we can expect to find in large quantities in the Kaupang soil are inorganic, hard, small objects of little value. Sherds of pottery provide a perfect case in point.

These factors will reduce the quantity of some types of find, and others will disappear from the assemblage completely. The influence of these three factors on the representativity of the different classes of material that have in fact been found in the settlement area of Kaupang is discussed along with the survey of the finds (pp. 421–5). In this section, these factors are discussed at a more general level, with a view to defining more precisely what the interpretative significance of the surviving collections of finds is, so that no conclusions are drawn which imply that what has survived is anything like the original whole.

The acid and relatively dry soil conditions in the stratified deposits at Kaupang will remove practically all organic material. There are also further post-depositional processes, such as trampling in the Viking Period and subsequent ploughing, that will have reduced the chances of survival of porous and other highly friable materials. Consequently, we cannot expect to find items such as fur, leather, textile, honey or wax, nor anything of wood such as chests, boxes and so on. There are indeed a few lucky finds of such things, for instance textile-impressions on items in graves (Ingstad 1999), a couple of wooden handles, and some pieces of a wooden cup from a well (C52517/3047 in A9062). There must have been a mass of such items, of which many would probably have been personal possessions, while materials such as textile and fur were probably trade goods too; but there is little basis for quantifying or qualifying these issues.

The latter two factors, the size and value of the objects, are inter-related, as large objects recovered by excavation would originally have been of little value while those of value were so small that it was difficult for their owners to find them if they were dropped. The largest items that were found in the excavations of 1998–2003 were worn stone artefacts with little re-usable value. One worn-down upper quernstone weighed 7 kg and was 50 cm in diameter (C52516/3462) while the largest sharpening stone weighed 6 kg and was 40 cm long (C52519/20382). The largest artefact which can be assumed to have had a real value was an axe of 1.35 kg measuring 23 cm along its largest dimension (C52519/19467). This was lying in the side aisle of building A301 and was not worn, suggesting it was placed there and abandoned rather than lost (below, p. 432).

Of objects of really high value only tiny pieces have been found. Finds of waste scraps of gold from the metalcasters' workshops are much rarer than of silver, copper alloy or lead, even though analyses of the crucibles show that gold was a raw material widely used (Pedersen, in prep.). Amongst the 249 silver objects, with a total weight of 600 g, only eleven weighed more than 10 g and two more than 16 g. Those two, a silver ingot 9 cm long weighing 48.3 g (C52517/579; Hårdh 2008:106–7, fig. 5.6) and a partly melted-together lump of silver of 29.8 g (C52517/1737; Blackburn 2008:32–4, fig. 3.1), are both so large that they had probably been hidden and abandoned rather than lost. The remaining pieces are probably unrecovered losses. Beads of glass or precious stones, of which nearly four thousand have been found, were probably mostly lost, although broken and deformed beads may have been discarded. The large number of whole beads, including beads imported from the Middle East and the Mediterranean, indicates that one bead was not of great value.

The grave goods do not reflect the material culture of Kaupang any more fully than the settlement finds, although they are a selection influenced by different factors. The soil conditions in the graves play more or less the same role as in the settlement. Obviously, size does not matter as much in grave finds, many types of material preserve differently in inhumations than in cremations, and burial custom influenced the selection of objects deposited in the grave.

The conclusion to this survey is that, through an analysis of the objects found in the settlement area, one simply cannot expect to achieve any comprehensive view of the trading contacts of Kaupang, or of where the inhabitants came from. Some artefact-types, such as glass beads, are found in such large quantities that it should be possible though to draw conclusions about where items like this mostly came from, and in what quantities. Larger objects, however, especially any of value, such as weapons or textiles, are almost completely excluded from this analysis. As there are whole categories of finds that cannot be included in the study, there may also have been trade with regions that have not been identified.

One equally cannot expect to be able to see the full spectrum of traded goods and personal possessions from a particular area; nor to quantify the volume of various goods and personal possessions brought in. It is difficult, as a result, to form any impression of the relative importance of contact with different regions in the economic life of the town, or of what proportion of the population came from various places. However, on the basis of the clearest of the patterns that emerge in the following analyses, and supported by analyses of selected grave material, it is nonetheless possible to draw a few tentative conclusions in the course of the present chapter and in the following one.

16.2 How items came to Kaupang

In order to be able to make use of the modes of importation described above in an analysis of the archaeological finds from Kaupang, they have to be systematized so that the various categories of find can unambiguously be linked to one of the modes. However, this is not a straightforward and simple matter. Two quite similar glass beads from the Caliphate may well have arrived in different ways: one in a necklace worn by an immigrant woman from Frisia, for instance; the other in a bag of beads brought by a merchant from the same area. An attempt is made here, nevertheless. The results of this discussion are summarized in Table 16.1.

Most of the *glass drinking vessels* are probably traded goods (Gaut, this vol. Ch. 9:248–53), while *pottery* and *metal jewellery that was not produced on site* arrived amongst the personal possessions of people who came from the areas where those items were produced and who settled in Kaupang either for a short term or a longer period (Wamers, this vol. Ch. 4:89; Pilø, this vol. Ch. 10:282).

In this period, pottery was either produced domestically or by local or regional specialists. As Pilø and Vince have shown (this vol. Chs. 10 and 11), the pottery at Kaupang was not locally made but rather imported from where it was manufactured (Tab. 16.1). There was no pottery production in western Scandinavia at this date. Cooking was mostly done in soapstone cauldrons, occasionally in iron cauldrons or by placing cooking stones in liquid in a container. The characteristics of the cooking vessel can govern what sort of food can be cooked, and these are very different in the cases of soapstone and pottery. It takes time to heat a soapstone cauldron but it then stays hot for a long time. A pot heats up quickly but it does not retain the heat. The different forms of vessel are therefore suitable for preparing different sorts of food, and have to be placed over the fire in different ways. The choice of cooking vessel is consequently linked to food traditions, and so to cultural identity; this point is very clearly illustrated by the fact that potting was never taken up at

Kaupang and the use of pottery did not spread out into the surrounding area even though imported pottery was used within the town.

Those who made use of pottery amongst the inhabitants of the town thus probably came from ceramic areas rather than from western Scandinavia (what is now Norway). It can be presumed that these settlers had pottery from their homelands with them when they arrived. Subsequently, as these pots were gradually broken, they were replaced with pots that members of the household brought back from journeys or which visitors brought for their own use.

But there were no really black and white dividing lines in the material culture of different ethnic groups. At multicultural sites such as this, processes of cultural transmission and assimilation emerge: terms for this are "creolization" and "hybridization". Such processes probably led to the adoption of objects that people of different origins had brought into the town. A low level of supply of objects from the people's original homelands would have contributed to the same process. There was such a shortage of pottery; for, as Pilø has shown, vessels that were originally produced as tableware or containers for transport were put to use as cooking vessels: he calls this "pragmatic" (this vol. Ch. 10:288).

One would expect creolization or hybridization to become evident only after several years of permanent settlement at Kaupang: both as the objects that had been brought in were gradually broken, and as people originally from different areas formed one community and perhaps intermarried. This may have led to a change, after which the local food-preparation customs and the more readily available soapstone vessels associated with those practices came into use. Some indications of such a development may be detected at the end of the history of the town (below, p. 433). Consequently, pottery is primarily evidence for the areas from which the visitors came in the first half-century of the town: in other words, the visitors in SP I and the settlers of SP II. In the later periods, presumably only relative newcomers would have held on to cooking practices and material culture from their homelands.

Although it is possible to identify the places of origin for most of the pottery types at Kaupang, the grey wares are more of a problem, and these account for fully 56% of all the sherds (2,975 out of 5,309). Only 17% of those can be provenanced (505 of 2,975). Of all the ceramic sherds, it is possible, as a result, to identify the origin of some 53% (2,839 out of 5,309 sherds; Pilø, this vol. Ch. 10).

Amongst the 505 grey-ware sherds that can be provenanced, Pilø has succeeded in identifying 273 as Slavonic on the basis of their decoration and a further 80 from the rim-type: 353 (70%) in total. The remaining 152 sherds (30%) are tentatively identified as southern Scandinavian on the basis of the rim-type (Pilø, this vol. Ch. 10:296–10). In this context, southern Scandinavia means Jutland, the Danish islands and Skåne.

The relative proportions of Slavonic and southern Scandinavian pottery within the whole collection of grey ware can be roughly assessed by looking at the proportions of identifiable rim sherds. Out of all the rim sherds of grey ware, fully 74% (232 of 313 sherds) can be provenanced on the basis of rim-type. Amongst these, Slavonic forms account for 26% and southern Scandinavian forms for 49% (80 and 152 sherds respectively; Pilø, this vol. Ch. 10:300). The possible proportion of the whole collection of grey ware that is Slavonic or southern Scandinavian is therefore high, probably around three-quarters. If roughly the same quantity of rim sherds represent any one Slavonic vessel as a Danish one, southern Scandinavian grey ware would have been twice as common at Kaupang as its Slavonic counterpart.

One could readily suppose that *jewellery of gold or silver* was obtained by Scandinavians elsewhere in Europe, either through trade or as plunder, and then brought as a personal possession to Kaupang. However, as Wamers writes (this vol. Ch. 4:89), items of jewellery of this kind, especially such as were functionally correlated with the style of dress, continued to be ethnic and cultural markers in this period so that it would not have been so much in the interest of Scandinavians to wear them.

Quite a different matter is that they might inspire the development of new types of Scandinavian jewellery, as is the case with the trefoil brooches, while individual items could be re-fashioned into dress-accessories of a Scandinavian type, such as happened with a number of ecclesiastical mounts (Wamers 1985; below, p. 440). As a general rule, however, and especially in the case of objects of low metal value, it is to be presumed that non-Scandinavian metal jewellery was brought to Kaupang as personal possessions by people coming from the same areas as that jewellery.

There is another angle to consider with the metal dress-accessories too: the finds from the settlement site are relatively small fragments, and it is possible that these had been chopped up for re-melting. If that took place in Kaupang, it does not affect the inference that the items had arrived as personal possessions. But it is conceivable that the material arrived as scrap metal (Hårdh, this vol. Ch. 3:58–61). Pedersen's studies (in prep.), however, show that it is more likely that most of the raw materials used by the metalcasters arrived in Kaupang in the form of ingots. In the excavations of 1998–2003, 17 silver, 82 copper-alloy and 99 lead ingots were found, either as parts or whole (Pedersen and Pilø 2007:tab. 9.1; Hårdh 2008:103–4). Moulds found show that ingots were made in Kaupang too, but the metallurgical analyses carried out for Pedersen show that the metalcasters in the town worked very largely with lead and copper-alloy ingots of pure metals or alloys of such as they would have come from the mines, and not with mixtures of metals of different alloys and from different sources (Pedersen, in prep.). No comparable studies of the silver and gold have been made, and probably there was more recycling of those two types of metal.

It is therefore reasonable to conclude, along with Pedersen (in prep.), that the most important raw material for the metalcasters, *precious metal*, probably with the exception of silver and gold, arrived in Kaupang as traded goods in ingot form. It is also reasonable to conclude that *jewellery* and *mounts* – possibly with the exception of some of the gold – arrived in Kaupang as personal possessions. That some of the dress-accessories, as the finds show, were subsequently chopped up as scrap does not alter this overall view. Although the fragmentary jewellery forms a high proportion of the finds of jewellery and mounts, one can assume that this is not because fragmentation was so common but rather because complete items of jewellery were very well looked after and were easier to find if mislaid, and so would much less often have ended up in the ground. This agrees with Pedersen's conclusion (in prep.): that the recycling of metal in Kaupang must have been smaller in scale in the 9th century than Hårdh believes (this vol. Ch. 3:58–61).

There is one further feature of the metal jewellery to be considered, specifically the silver jewellery. In the second quarter of the 9th century, *jewellery*, *payment rings*, *coins* and *silver ingots* started to be used as forms of currency, usually hacked into pieces. During the second half of the 9th century silver became more common as currency, and in the 10th century it was in widespread use through most of southern and central Scandinavia (Blackburn 2008; Hårdh 2008:113–18; Pedersen 2008:159–66; Skre 2008d:347–52). Throughout this period, and earlier too, it also served as the metal for dress-accessories (personal possessions) and the raw material for metalcasters (traded goods). When it takes the form of silver currency, the silver has to be regarded as a traded good; as a specific type of commodity-currency which the person who had it could choose to use as raw material for jewellery and thereby convert into a personal possession. Such conversion from currency to jewellery stopped when minting became well established in the Scandinavian kingdoms in the 11th century laws against the melting down of coinage were applied.

The various types of silver currency are widely spread throughout Scandinavia, and this is linked to the function of the metal. It is difficult, as a result, to identify definite areas of origin for the various types. Certain forms, however, occur more in some areas than in others, and on this basis some of the types that appear in Kaupang can be considered to have come from southern Scandinavia (Hårdh 2008; Skre 2008d:348–51). Other types are found mostly in eastern Scandinavia and Ireland, but the identification is less secure in these cases. Finally one can assume that ingots and possibly other items which had been cast in Kaupang were put to use as silver currency. Most of the coins are from the Caliphate, although there are a few Carolingian and Anglo-Saxon specimens (Blackburn 2008; Rispling et al. 2008). Weights for measuring the silver currency are mostly of local manufacture, but some have incorporated Insular metalwork from the 9th and 10th centuries, and the cubo-octahedral and spherical types that appear in the final third of the 9th century and into the 10th century very probably arrived as personal equipment from south-eastern Scandinavia where such weights are found in large quantities (Pedersen 2008:121, 131).

The sources of *lead* can be identified through the metallurgical analyses undertaken by Arne Jouttijärvi (2005, 2006) and the further work of Unn Pedersen (in prep.). The results are that the 49 lead objects analysed can be divided into seven groups, apparently from different sources. Two groups are of greatest relevance in the present context because they are not only relatively large but also chronologically well located. Pedersen's Group 1, which is strongly linked to SP I–II, comes either from the South-East of France or the English Midlands. Pedersen's Group 2 is also present in SP I–II, but also in later contexts (SP III) and in two objects that can be dated on stylistic grounds to c. 890–950. The lead in this group has its closest parallels in lead from mines in the North-West of England. A third group, Pedersen's Group 4, is relatively small, but is clearly limited to SP II, and this can be assigned to the Rhineland, south-western England, or the English Midlands.

There is a range of raw materials other than precious metals that was imported for local production in Kaupang. This comprises *copper alloy*, *amber*, *glass for beadmaking* and *iron for smithing*. All of these probably arrived for the most part as traded goods; in some cases, possibly, distributed through the craftsmen's own network. The casting of copper alloy appears in Kaupang as early as SP I and continues in SP II and later (Pedersen, in prep.; Skre, this vol. Ch. 15:401, 405–6, 409–11). This metal was probably supplied to Scandinavia in the 9th century from the Rhineland, perhaps especially from the regions around Aachen, and in the 10th century from the Caliphate (Sindbæk 2005:64–6; Pedersen, in prep.). Amber occurs naturally along the southern coast of the Baltic, around Denmark and along to the Frisian coasts (Resi, this vol. Ch. 6:107–9, Fig. 6.1), while glass was mostly produced around the Mediterrenean and in France (Wiker, in prep.). Iron

	Western Scandinavia	Eastern Scandinavia	Southern Scandinavia	Slavonic areas	Frisian, Carolingian	Britain and Ireland	Islamic, Mediterranean
Traded goods							
Cornelian beads							
Rock crystal beads							
Glass beads							
Copper alloy – raw material							
Textiles							
Coins							
Jet items							
Lead – raw material							
Hacksilver, unminted							
Glass beads – raw material							
Vessel glass							
Amber – raw material							
Whetstones, dark schist							
Iron							
Whetstones, light schist							
Soapstone vessels							
Personal possessions							
Metalwork							
Pottery							
Weights							
Soapstone, non-vessels							

Table 16.1 *The assumed mode of importation and areas of origin for goods and raw materials brought into Kaupang, as discussed in section 16.2. Goods that were also produced in Kaupang are shown in italics. The possible supply of jet and rock crystal as raw materials is not included, as this is uncertain, and would involve only very small quantities (Resi, this vol. Chs. 6 and 8).*

was produced in great quantities from the interior of southern Norway, and the supply to Kaupang presumably came from there.

Whetstones and *objects of soapstone* come from areas closer to Kaupang. In the case of the objects of soapstone, there is a difference between traded goods and personal possessions. Geological analyses carried out for Baug show that the majority of the cauldrons were produced from the same quarry. This indicates large-scale production, and it would seem most plausible that the cauldrons arrived in Kaupang as traded goods. The majority of the small objects of soapstone, by contrast, are from different quarries, and it seems most likely therefore that these were brought in as personal possessions (Baug, this vol. Ch. 12:329). Whetstones are for the most part from two places, one in Eidsborg and one either in western or the interior of eastern Norway, and these very probably arrived primarily as traded goods (Resi, this vol. Ch. 14:374–5).

Amongst the objects of *jet* or *jet-like material*, armrings are found in Kaupang in numbers and of a uniform shape that strongly imply they came to the town as traded goods rather than as personal possessions (Resi, this vol. Ch. 6; Plather, this vol. Ch. 7). These rings had no function that links them to a costume tradition specific to a certain ethnic group, nor had the jet beads. Jet, then, is treated as a traded commodity in this chapter. Armrings of this kind were produced in large quantities in the Scandinavian settlement at Dublin (Hunter 2008:108 and 112), and were therefore probably used by that town's Scandinavian population.

The question of whether *textiles* were goods of Viking-period long-distance trade is indissolubly linked to the term *pallia fresonica*, "Frisian clothing". On the basis of her studies of the textiles from Birka, Agnes Geijer (1938) put forward the hypothesis that an especially fine textile woven in a variant of diamond twill was what the written sources refer to as *pallia fresonica*. This discussion has subsequently been taken up by several others, including Lise Bender Jørgensen (1986:173–6), who has argued that this special type of textile was produced in western Norway. Basing herself on the textile finds from Kaupang, however, Anne Stine Ingstad (1999:238) argued strongly that this type of diamond twill, which is quite common in the graves at Kaupang and Birka, and which in Scandinavia is found around the Baltic shores and in southern Norway, also has close parallels in the Alamannic regions, and that its area of origin was further east. This de luxe type of textile may, then, have been one of the wide variety of goods that arrived in the Baltic region through oriental trade, and so on to Kaupang.

But this idea is far from a proven fact; the linkage of this textile to *pallia fresonica* is unconfirmed; and the questions of the degree to which this textile was one of the goods that were imported into Kaupang, and if so, where it came from, have to remain open. Locally produced textiles were certainly predominant amongst those that were in use in Kaupang; as traded goods, however, the Caliphate and the Frankish/Frisian lands can be counted as possible sources of textiles.

16.3 Trade routes

Following the discussion in section 16.2, summarized in Table 16.1, it is possible to seek to identify Kaupang's trade routes. This section is structured according to the areas of origin of the types of object in question.

16.3.1 Goods from the Caliphate and Mediterranean lands

From the Caliphate and the Mediterranean lands came coins, beads of glass, cornelian and rock crystal, probably also ingots of copper alloy and possibly textiles. The route these followed, however, varied in the course of the long period over which such goods came to Kaupang.

In the MRE, several types of glass bead and cornelian beads appear as early as SP II – i.e. in the first half of the 9th century – while rock crystal beads and coins are found only in disturbed contexts of post-850 date. The sum total of rock crystal beads from the excavations of 1998–2003, however, is quite low (N=28; Resi, this vol. Ch. 8:Fig. 8.1), and their absence from SP I–II may therefore be a matter of chance. Like cornelian beads, rock crystal beads were found in two graves of the first half of the 9th century (Ka. 265 and Ka. 299), and probably both types of bead were imported to Kaupang from the first half of the 9th century onwards.

This agrees with the general view of when rock crystal and cornelian beads appear in Scandinavia. As Jansson has pointed out (1988:586–7), the chronology of this importation of beads agrees with that of the importation of Islamic coins to eastern Scandinavia and the Baltic, and it is reasonable to suppose that the beads and the coins followed the same trade routes from the Caliphate. The option that the beads arrived in Kaupang as early as anywhere else in western Scandinavia, but that coins from the Caliphate did not reach the town until after 850 (Blackburn 2008; Kilger 2008a), may be linked to the policy of melting down foreign coin that was apparently enforced in the Danish kingdom until the middle of the 9th century (Skre 2008d:350). Beads, meanwhile, were circulating freely in the trading zone of Scandinavia and the Baltic. Beads of cornelian and rock crystal are not found at this period in Frisian lands or the Rhine valley (Gabriel 1988:Abb. 36; Hepp 2077:Abb. 30), so it seems impossible for such beads to have arrived in Scandinavia from the West.

In the case of glass beads from the Caliphate and the Mediterranean lands, however, one has to reckon with a western route as well as one from the East. What Wiker (in prep.) calls oriental beads, deriving from an area that stretches from the Mediterranean eastwards through the Byzantine Empire and the Caliphate to India, appeared in Kaupang just as early as beads of cornelian and rock crystal. There are 2,454 oriental beads: the majority of the beads from the excavations of 1998–2003 (N=3,588; Wiker, in prep.). This group consists of a series of different types, and, unlike the cornelian and rock crystal beads, some of these types have a clearly western European distribution. With their close and early dating, and their high frequency in Kaupang, it is especially the segmented beads (N=624) and the mosaic eye beads (N=41) that are of interest in the present context (Wiker, in prep.).

Mosaic eye beads are datable c. 790–850. The variants that are most common at Kaupang occur in northern Europe primarily in Frisia and western Scandinavia, and are quite infrequent in eastern Scandinavia and around the Baltic. They must have come to Kaupang and elsewhere in western Scandinavia from Frisian lands (Wiker, in prep.). This view of a western trade route to Kaupang in the first half of the 9th century is corroborated and extended by the chronology and distribution of the segmented beads. Such beads began to arrive in Scandinavia at the end of the 8th century, first from the East but gradually also over a western route too. Their high frequency in Ribe from c. 790 to 820 shows that these beads were a feature of the Frisian trade, and it is those variants that were coming to Kaupang at that date. As Wiker shows (in prep.), the variants of segmented beads that were arriving in Kaupang after c. 850 have a more easterly distribution, and it is probable that they came to the town from the Baltic region rather than, as previously, from Frisian lands. Some variants of the mosaic eye bead may then have been delivered from this late, easterly route (Wiker, in prep.).

In the 10th century, copper-alloy ingots were also supplied via the eastern route from the Caliphate; but finds of these are few, and the chronology is therefore less precise than that of the glass beads. There are, however, no such ingots in Staraja Ladoga or the other Russian sites before the 10th century, so their importation to Scandinavia from the Caliphate can hardly pre-date that. In the 9th century such ingots must have reached Kaupang from western Europe (see section 16.3.2).

An assessment of the importation of coins, copper-alloy ingots, textiles, and cornelian, rock crystal and glass beads from the Caliphate and the Mediterranean lands thus shows that from some time in the first half of the 9th century and subsequently throughout the history of the town goods were arriving from the Caliphate via the eastern parts of Scandinavia. In the first half of the 9th century such goods were also supplied to Kaupang from the Frisian lands. After c. 850 the latter trade route is no longer visible through these categories of find, but this could be because the importation of mosaic eye beads to Scandinavia did not continue very much longer. The question of how long the Frisian trading was maintained will be considered further in the discussion of other sets of finds below (section 16.3.2).

16.3.2 Goods from the southern North Sea region

From the 7th century into the middle of the 9th century, Frisian traders controlled the majority of the sea-borne trade in the southern North Sea region. Their trading expanded in the course of the 8th century to reach a zenith in the period c. 770–830, with Dorestad having become their most important harbour (Lebecq 1992, 1998). The Frisians transported goods from their homelands to Frisia, Jutland and eastern England as far north as York, and between harbours in these areas. They also participated in the Baltic trade, especially that between Hedeby and Birka (Lebecq 1992:7, 1998:69). The trading of the Frisians at Kaupang has not been discussed so extensively in published work, but as the following discussion and section 16.4.1 will show, Frisians were both trading and settled in Kaupang. From the Frisian and Frankish lands there are coins, lead, copper alloy, raw glass for beadmaking, drinking glasses, and maybe also amber and textiles. As already noted, some goods from the Caliphate arrived via Frankish/Frisian lands.

Sindbæk (2005:65) identifies evidence that, in the 9th century, ingots of brass were reaching Scandinavian metalcasters from production sites in the Rhineland. The metallurgical analyses that Pedersen and Jouttijärvi have undertaken also show that lead was coming in from the southern North Sea region (Pedersen, in prep.). A large amount of lead from SP I–II can be traced back to France or the English Midlands (Jouttijärvi/Pedersen Group 1), and a smaller number of lead objects to the Rhineland, south-western England or the English Midlands (Jouttijärvi/Pedersen Group 4). Lead from mines in southern England was available to Frisian traders through the dynamic trade between ports on both sides of the English Channel which supplied goods to Dorestad (Middleton 2005), while lead from the English Midlands could have been obtained in ports such as Ipswich or York. The finding of two coins from East Anglia struck c. 800–821 (Rispling et al. 2008:nos. 9–10) supports the case for a connexion with Ipswich, the English town situated closest to Dorestad. As Blackburn writes (2008:56), such coins are extremely rare in Scandinavia, and must have come to Kaupang from their area of origin in the first quarter of the 9th century. The three Carolingian coins, and possibly one from Ribe, all struck c. 825–840 (Rispling et al. 2008:nos. 6–8 and 11), must also have been introduced through the Frisian trade. It would therefore appear reasonable to infer that the Frisian trade supplied the metalcasters of Kaupang with both lead and copper alloy in the first half of the 9th century, and with copper alloys possibly later in the 9th century too.

Gaut's study of the rich assemblage of fragments of drinking vessels from Kaupang (this vol. Ch. 9:248) shows that these objects were mostly from Frankish areas, especially the Rhineland. The typological datings of such finds are imprecise, and the contexts in Kaupang only confirm that glass beakers were imported throughout the first half and some way into the second half of the 9th century (SP I–II). In the following period it is not securely demonstrable that the importation of glass beakers continued, although there is circumstantial evidence that this was the case. The fact that four of Sherd Families identified by Gaut are only found in the ploughlayers may mean that glass vessels were also in use and being broken after c. 850, and the dating of some types could continue beyond the final phase at Kaupang (Gaut, this vol. Ch. 9:225). The conclusion must therefore be that Frankish drinking glasses probably continued to arrive in Kaupang right into the 10th century, although that cannot be proven.

Raw glass for the manufacture of drinking vessels in Frankish areas was produced in the Mediterranean area and the Near East down to the end of the 8th century, when it was supplemented by local supplies (Gaut, this vol. Ch. 9). Some of this raw material moved on to Scandinavia – to the beadmakers of Kaupang amongst others. Wiker (in prep.) shows that beadmaking in Kaupang, at the beginning of the 9th century and no later than 825, predominantly made use of white and blue glass and some green. After a break, production re-started around 850, or a little after, when it was primarily green glass that was used. This period of production may have continued some way into the 10th century. Both in the earliest and the later period of production, types of glass were used that were commonly employed in the Frankish glass-manufactories at the time (Wiker, in prep.). The raw material for the beadmakers of Kaupang must have come from these lands in both of the periods of production.

Two less-certain types of imported goods from the Frankish regions are amber and textiles. Amber is a possibility only because this material must have been imported to Kaupang, because the Frisian coast is one of the places where amber occurs naturally, and because large quantities of amber, evidently accumulated for sale, have been found in Dorestad. But the amber at Kaupang could just as well have come from Danish territories or from the Baltic – in the 10th century possibly from Wolin, which appears to have exported amber in large quantities in that period (Resi, this vol. Ch. 6:122). In the case of textiles, the historical term *pallia fresonica* indicates that this was a commodity traded by the Frisians, and fine textiles have been found at Kaupang (Ingstad 1999). But, as discussed above (p. 425), there is no definite evidence for which types of textiles were made where. It remains uncertain to what extent traders from the Frisian areas imported amber and textiles to Kaupang.

The chronology of the importation of goods from the Frankish territories thus reinforces the picture which emerges from the analysis of the types of glass bead from the Caliphate and the Mediterranean lands that were supplied to Kaupang via western Europe (above, p. 426). Coins, glass beakers, ingots of copper alloy and raw glass, and possibly of lead ingots, were arriving in Kaupang as traded goods from the Frankish lands in the first half of the 9th century. Trade in goods from these areas can be traced right back to the foundation of the town. There appears also to have been some trade with the more southerly kingdoms of England, specifically Mercia, which was then in control of East Anglia, where the two coins found at Kaupang were struck, and from where lead may have been shipped. Frisian trade extended to these areas too, and it is possible that it was Frisians who brought these goods to Kaupang; the alternative is probably that Scandinavians did so.

Because of the lack of intact stratified deposits at Kaupang after c. 850 it is harder to form a clear view of importation from Frankish/Frisian lands in this period. An impression has to be based upon finds from disturbed contexts that are more affected by post-depositional processes and which can only offer typological datings, usually less precise than the stratigraphic datings from the MRE. All the same, some trends seem to be clear. Carolingian coins are not numerous, but their date-range is unambiguous: these appear only before c. 850. The importation of lead appears practically to have ceased after c. 850, as lead with the isotopic signatures that point to the Frankish lands is firmly linked to SP II. The dating of the importation of ingots of copper alloy after c. 850 is not so clear. Before then these must have come from the Rhine region, but all that is known about the supply in the second half of the 9th century is that such ingots were not coming from the Caliphate to Russia before the 10th century so that it is reasonable to infer that supplies to Scandinavia in the 9th century must have been from the Frankish lands, where such alloys were being produced. In the case of glass beakers and raw glass too, importation from the Frankish areas is most securely documented in the first half of the 9th century. However it would appear reasonable to suppose that this supply continued on into the 10th century.

Altogether, it would appear, then, that there were changes in trade with the Frankish lands throughout the functioning period of Kaupang, and especially in the period around AD 850. The issue of the character and extent of these changes will be considered further in Chapter 17.

16.3.3 Goods from southern Scandinavia, the Baltic and the Irish Sea

Through the examination above of the goods that had come to Kaupang from the Caliphate, it was revealed that from the very beginning goods were reaching the town via the Baltic and southern Scandinavia. It is not so easy, however, to identify objects that originate there. Amber may have been supplied from the southern shores of the Baltic and from Danish territories, but this is unproven. Most of the types of hacksilver found in Kaupang in the second quarter of the 9th century also occur in the Baltic lands and southern Scandinavia (Hårdh 2008; Skre 2008d:348–51), however, this cannot be taken as evidence that they were produced there but rather that silver circulated between Kaupang and the towns and trading places of southern Scandinavia and along the Baltic coasts. There must have been goods from the Baltic and southern Scandinavia all the same, but these were probably amongst those types which do not survive in the archaeological remains because of their size, value or material (see above, 16.1.3). This question is discussed further in Chapter 17.

There are slightly firmer traces of trade with the lands around the Irish Sea. Amongst the types of hacksilver that are found in southern and south-western Scandinavia there is one type that has a predominantly western distribution: dating from the 9th century, and known as "broad-band armrings", seven fragments have been found in Kaupang. As well as in Denmark, these also turn up in hoards from the coastlands of southern and western Norway from Viken to Møre, and in several finds from Scotland and Ireland (Hårdh 2008:97 and 113–14). On the basis of their chronology and distribution, John Sheehan (1998:178 and 194–5) has concluded that the earliest rings of this type were manufactured in Denmark and that in the middle of the 9th century – in other words from the beginning of Scandinavian settlement in Ireland – they were part of the repertoire of Hiberno-Norse silversmiths in Ireland, who continued to produce such rings into the 10th century.

These armrings were quite coarsely hammered out from weight-controlled silver ingots, and should be regarded first and foremost as a way of storing wealth and as silver currency (Sheehan 1998:178). The large number of fragments of armrings produced either in Ireland or Denmark at Kaupang and in the treasure hoards along the Norwegian coasts shows quite clearly that these areas were linked into traffic between Denmark and Ireland. But when was that? The armrings from the hoards of the Norwegian coastlands had come from Ireland and were deposited in the first half of the 10th century, except for that from Torvik in Volda, Møre, which appears to be from Denmark and to have been deposited in the second half of the 9th century (Sheehan 1998:194; Hårdh 2008:113). The seven fragments from Kaupang cannot be closely dated as they were found in undated contexts, and in only one case can the place of manufacture be determined – this is an Irish type (C52519/14058; Hårdh 2008:114). Such armrings were also in circulation in northern England. With this evidence, the involvement of Kaupang in trade with the islands in the West cannot be pinpointed more exactly than to Northern Britain and Ireland and it cannot be more precisely than across some indeterminate range within the period c. 850–940.

The presence of 23 objects of jet or jet-like material (hereafter called jet), however, suggests that trade with these lands was also a feature of the first half of the 9th century. Jet occurs in all Site Periods at Kaupang, and in two 9th-century grave finds (Resi, this vol. Ch. 6:125). Unn Plahter's analyses of the finds show that the source of the raw material is uncertain: there are deposits in several places, including France and the British Isles (this vol. Ch. 7:140). Resi's study of the types of find, however (this vol. Ch. 6:125, 127), provides clear evidence that parallels to the types found at Kaupang are present only in Britain and Ireland: specifically in Dublin and York. The analysis of the York finds shows that the variance between different kinds of jet-like material in the armrings is very similar to the observations made by Plahter with corresponding finds from Kaupang. The quantity of finds in York, however, seems to be very limited, and there is no evidence that production was on a large scale (Mainman and Rogers 2000:2498–500). However, exactly large scale production *is* implied by the very rich finds from Dublin, as yet unpublished (Hunter 2008). Although the York and Dublin finds are of a later date than the Kaupang finds, the typological similarities as well as the nature of the raw material strongly suggests that the jet finds from Kaupang originate in Northern England or Ireland.

One further item of evidence that contact with the Irish Sea coasts continued throughout the functioning life of Kaupang has been produced by the isotopic analyses of lead from the excavations of 1998–2003 carried out for Pedersen (in prep.). Her large Group 3 is probably from mines in Cumbria, in the North-West of England, or the southern Pennines in Derbyshire. The samples are found in all three Site Periods, and amongst the datable objects outside of datable contexts there are two that can be dated stylistically to 890–950 (Pedersen, in prep.). Lead from these areas was thus being supplied to Kaupang throughout the history of the town.

It makes sense to link both lead and jet to trading between Kaupang and the shores of the Irish Sea or perhaps the eastern coasts of Northern England. Both materials appear in much greater quantities at Kaupang than at comparable sites elsewhere in Scandinavia (Pedersen, in prep.; Resi, this vol. Ch. 6), and this must be linked to the fact that it was particularly from western Scandinavia that contacts with the Irish Sea were cultivated (Wamers 1985:45–57). Scandinavians were present in the Irish Sea on a regular basis as early as the first half of the 9th century, and from c. 840 were permanently settled in Dublin and elsewhere. Both lead and jet could also come from York or other places along the North-eastern coast of England, but this is more likely in the later period. Contact with this area was sporadic until c. 870, when York was annexed and the region came under Scandinavian rule that continued, with short breaks, until 954. The material from Ireland clearly shows that the activities of the Scandinavians were strongly motivated economically from the start: realized at first by plundering, and then from c. 840 by a permanent presence that provided greater opportunities for trade. Irish annals reveal that slaves were amongst the goods the Scandinavians transported east from Ireland.

A single lead disc of Pedersen's Group 5 with Irish decoration made of lead from Scotland is the only artefact connected to Scotland. Since the sea-route to the Irish went along the coasts of Scotland, and as there was early and significant Scandinavian settlement there, trade should have included a broader spectre of items from these lands too. Such, however, are not amongst the types of object that have survived in the soil at Kaupang.

16.3.4 Goods from western Scandinavia

Western Scandinavia comprises those lands which now form the kingdom of Norway: from Viken in the South-East, through the Opplands (the interior north and north-west of Viken) and the land west of Viken over to the west coast, and north to Trøndelag and North Norway. As noted above, this is not a hinterland study, and so goods of category 1 are excluded from this analysis (above, p. 419). Goods of category 2 are included, however, even though they come from quite close to Kaupang. These include whetstones from Telemark and soapstone vessels from Viken and the southern Opplands. Other goods from western Scandinavia are dark schist whetstones and iron (Tab. 16.1).

Most of the soapstone vessels seem to have come to Kaupang from the same quarries, probably from the quarries closest to the town in Viken (Østfold), the southern Opplands (Romerike and Hadeland), and eastern Telemark (Rjukan). Baug (this vol. Ch. 12:Tab.12.13) notes a correspondence between one vessel sherd from Kaupang and samples from the quarry at Piggåsen in Romerike, and this may have been the most important source of such artefacts. But the work on the identification of the geological signatures of the various soapstone quarries is only just beginning, and the results have to be treated with caution, as Baug emphasizes.

The finds both from Kaupang and from comparable sites in southern Scandinavia show that trade in soapstone vessels began in the early decades of the 9th century and then expanded to a peak in the 10th century (Stylegar 2007:80–1; Baug, this vol. Ch. 12:334–7). The majority of the items that Baug had analysed in respect of their source – 19 samples out of 24, of which 17 were vessel sherds – dated from SP II or SP III: in other words in the 9th century. Those from SP II (N=12, including 9 vessel sherds) are securely datable to the first half of the 9th century, but it is less clear how far into the second half of the 9th century the objects of SP III (N=7, including 6 vessel sherds) extend (Pilø and Skre, this vol. Ch. 2:25–6). The two vessel sherds from unstratified contexts cannot be so closely dated. Baug's conclusion that the vessel sherds appear to come from the same quarries could therefore relate to the whole period of activity at Kaupang, although it might only apply to the first two-thirds of the 9th century.

Baug's study shows, all the same, that the supply of soapstone vessels to Kaupang for the majority of the 9th century followed the same route. There are several conceivable explanations for this. It is possible that the supply of soapstone vessels to the inhabitants of Kaupang in this time was influenced by relations of power rather than by different suppliers operating in an open market. Kaupang's local big men – be that the king of the Danes, his representative, or local men of power (Skre 2007j:466–8) – may themselves have controlled production from the soapstone quarries, either directly or through some elite alliance. It is also conceivable, though, that production was not controlled by any powerful individual associated with Kaupang but rather by someone who had established himself as the dominant supplier of such goods in Viken in the first half of the 9th century, if not throughout the century to which this production and trade belong. The relatively limited output of soapstone vessels in the 9th century may have made it possible to establish and maintain such a position within a particular region. Both of these possibilities imply that the goods were produced quite close to Kaupang, and Baug's identification of Piggåsen as a possible source seems plausible.

In addition to the soapstone, only two traded goods from western Scandinavia have been found at Kaupang, namely whetstones of light and dark schist respectively (Resi, this vol. Ch. 14). Just how narrow an impression of the true range of traded goods from this area these particular goods leave us with can be seen through the account of Ohthere's voyage. Around the year 890 he travelled from his home in Hålogaland to Skiringssal and Hedeby, and then apparently on to King Alfred's court in Winchester. The report does not state what he brought with him to the two first-named towns, but his account of the range of goods he obtained in his home area as tolls from the Saami and of which goods he brought for the king probably give a good impression of what sort of goods he had with him to trade. We hear of furs, hides, down, and ropes of seal and walrus skin (Bately 2007:45–6): all in all, goods that would not have survived for any length of time in the acid and porous soil at Kaupang. The exception is walrus ivory, of which the 1998–2003 excavations at Kaupang have produced only one artefact, a gaming piece (C52519/9741; Kristensen 2007). Both the value of the material and the acid soil conditions at Kaupang will be reflected in the rarity of such finds, and the low number of finds of walrus ivory should not, therefore, be taken as evidence that trade in this commodity was on a small scale.

Although there are many goods that are absent from the finds from Kaupang, whetstones of light or dark schist are plentiful. Different grain sizes in the two types of stone mean that dark whetstones are better for fine polishing, either of small edged tools or for the sharpening of larger tools, while the light whetstones are best for coarser grinding. These characteristics, however, are not sharply contrasted, and the same whetstone could be used for either task. The differences in quality were recognized, however, and appreciated in the Viking Period, as whetstones are commonly found in pairs in Norwegian areas, one of light schist and one dark (Resi 1987a:98, fig. 3, this vol. Ch. 14:375).

No quarries that can be dated to the Viking Period and from which dark-schist whetstones were produced, are known. However the quarries from which the stone was taken must have lain in the Caledonian belt that runs from North Norway along the west coast of Scandinavia and on through Scotland and Ireland (Askvik 2008:8; Resi, this vol. Ch. 14:375). The outcrops closest to Kaupang are in Rogaland and in the northern parts of the Opplands: in Valdres, Gudbrandsdal and Østerdal (Resi 1987a:fig. 1). The finds from Kaupang have various shades of colour and so probably come from different quarries within those areas (Askvik 2008:8).

The source of the light schist is more easily identified. The quarries at Eidsborg in Telemark were operating from before the Viking Period up until around 1950. The age of the rock, the lack of other quarries for this stone, and comparative microscopic examination of samples from Eidsborg and finds from Kaupang "strongly indicates that this group of whetstones comes from Eidsborg" (Askvik 2008:7).

Whetstones of dark schist occur in the very earliest layers at Kaupang, and in large quantities through all of the Site Periods: continuing, therefore, into the second half of the 9th century (Resi, this vol. Ch. 14:Fig. 14:15). Light-schist whetstones do not appear in SP I, and are present in moderate quantities in SP II and SP III. The large amount of both types of whetstone in the medieval plough-layer gives no reason to suppose that the supply of either ceased before the town was abandoned. But the higher percentage of light schist in the medieval plough-layer as compared to in SP II (33% versus 10% of total schist) might indicate that the availability of those improved after c. 850. The trading connexions with the areas from which the whetstones derive would thus appear to have been maintained throughout Kaupang's functioning life; for the light schist possibly starting a few decades later and then increasing in volume in the late 9th century.

In the whole assemblage, dark whetstones are four times more common than the light ones, which also seem not to have been introduced to Kaupang before SP II. The chronological gap in the introduction of the two types is nevertheless small, and there is nothing to suggest that it could have influenced the quantitative relationship between the two groups in the whole assemblage. The great predominance of dark whetstones amongst the finds from Kaupang must either be due to the fact that these were more readily available, or that the greatest need was for whetstones for fine polishing.

Iron is found in large quantities at Kaupang, and it was almost certainly supplied from the large-scale production in the Opplands: in Telemark and Agder, and especially in the upland forest regions and lower mountain ranges (Larsen 2004:150–2, fig. 7). Elsewhere in western Scandinavia iron production was practised on a large scale only in Trøndelag (Larsen 2004), and there is no reason to believe that the iron at Kaupang was brought all the way from there.

Iron is present in all of the Site Periods, and the supply routes must have been well established. On Plot 1A in Site Period II two iron rods were found weighing 100 and 200 g respectively, which could be pieces of iron ingots (Skre, this vol. Ch. 15:402). The coincidence in the areas of iron production and the natural outcrops of light and dark schist suggests that all three commodities could have followed the same trade routes from the Opplands and Telemark.

These discussions show that all of the goods from western Scandinavia that can be identified amongst the finds from Kaupang could well have come from the Opplands, Telemark and Viken. There is nothing that must have come from the lands along the west coast from Rogaland to Finnmark, although, as noted, goods from there could have been of those types that would not have survived in the Kaupang soil. The finds from Kaupang thus render it difficult to tell if traders from Ohthere's homelands and elsewhere on the west coast were frequent or infrequent visitors to Kaupang, but both possibilities must simply remain open.

16.4 The settlers

Where were they from – those who lived at Kaupang, firstly only seasonally in the period with no buildings (SP I), then mostly seasonally at the beginning of SP II, before becoming permanent settlers a couple of decades into the 9th century (Skre, this vol. Ch. 15:413–15)? As in the study of the traded goods, it is the imported items in Kaupang that allow one to suggest answers to this question. However in this case too, the circumstances that have shaped the selection of items from the "live" assemblage at Kaupang set clear limits to the precision of the answer.

16.4.1 Settlers from the southern North Sea region

It is clear, from the finds, that both women and men from the Frankish/Frisian lands were resident in Kaupang. Frankish pottery constitutes 26% and Frisian 8% of the ceramics from stratified deposits, and the great majority of these vessels must have been brought in as personal possessions. The eleven pieces of Frankish metalwork are dress-accessories, or fittings from weaponry or riding gear. These bear no signs of re-working as is otherwise usual on Frankish objects found in Scandinavia, and it is reasonable to interpret them, as Wamers does (this vol. Ch. 4:89–90), as personal possessions of Franks who brought them to Kaupang. With one exception, the Frankish dress-accessories are of types that were part of everyday dress, and Wamers (this vol. Ch. 4:90), identifies their wearers as traders and craftsmen. The metal items are from Frisia or northern France, as are the seven pieces of metalwork from graves at Kaupang (Wamers, this vol. Ch. 4:90–1). This indicates that the settlers were from the same areas within the Frankish Empire as the traded goods (above, p. 426–7). They were probably Frisians.

It is, however, conceivable that the finds were left by Franks or Frisians who were purely visitors to Kaupang and did not settle there. Moreover some Frankish dress-accessories, such as equal-armed brooches, were adopted in the Scandinavian female costume. The discovery of one such brooch in the grave of a woman whose jewellery is otherwise Scandinavian in style and function (Ka. 203–4), shows that these items of metalwork were worn by Scandinavians (Wamers, this vol. Ch. 4:90). But, as will be shown in what follows, the assemblage of finds in one of the six buildings excavated in the MRE shows that Franks or Frisians not only visited Kaupang but settled there permanently.

A Frisian merchant's house

Several finds associated with building A301 on Plot 3B render it probable that the inhabitants were Frisian traders. These comprise Frankish female jewellery and a much higher frequency of Frankish pottery and drinking glasses than in any other building, besides a wider range of other Frankish or Frisian imported goods.

The three Frankish female dress-accessories are an equal-armed brooch, a cross brooch and a double-ended dress-hook (C52519/14481, C52519/14951 and C52519/28305; Wamers, this vol. Ch. 4:74–9, Figs. 4.8.1, 4.9.2 and 4.11.1). These are everyday costume items associated with Frankish women's costume and which, with the possible exception of the equal-armed brooch, can hardly have found any use outside of their own cultural zone. The double-ended dress-hook would have no use on contemporary Scandinavian female dress. These were not traded goods, and are of copper alloy of no particular value and so will scarcely have arrived in Kaupang as plunder.

The equal-armed brooch and the cross brooch were found, respectively, in the modern ploughsoil and the medieval plough-layer immediately above the southern wall bench of building A301, while the double-ended dress-hook was found in a layer of sand that was one of the latest fills of the ditch that separated Plot 3B from the neighbouring plot to the North, 4B. The occupation deposits in this building had been damaged by ploughing, which would have brought items within them up into the overlying medieval plough-layer. Analysis has shown that the lateral movement of objects in this layer was small (Pedersen 2008:158), and it is not unreasonable to suppose that these two objects in the ploughsoils are from occupation deposits within A301 disturbed by ploughing. It is also reasonable to suppose that the latest preserved layers within the boundary ditch immediately north of A301, where the double-ended dress-hook was found, were deposited while the building was still in use.

These inferences are supported by the dating of the objects. A301 was constructed in the early 9th century and went out of use c. 840/50. This agrees well with the dating of the cross brooch, which is from the period 800–850. The other two objects are less narrowly dated to c. 750–900 (Wamers, this vol. Ch. 4:Tab.4.1, Fig. 4.23). Only one other item of Frankish metalwork was found within the area of excavation, and the clear concentration on Plot 3B seems too great to be coincidental. Considered in light of the dating and the stratigraphical context of the objects, the clustering suggests that the dress-accessories were used by inhabitants of building A301.

The quite special accumulation of Frankish female dress-accessories may mean that one or more Frankish women lived in this house. This idea is supported by two further categories of find, pottery and glass beakers. Fully 50% of the 22 sherds of pottery from A301 are Frankish or Frisian: either Frankish Vorgebirge wares (3) or Frisian shelly ware (8). When the grey ware with no identified provenance is excluded, 92% of the ceramics from this building are Frankish or Frisian (Tab. 16.2). The amount of Frankish or Frisian pottery in this house is thus nearly twice the average for all of the plots in SP II (27%; Pilø, this vol. Ch. 10:Tab. 10.11). The only plot with a similar frequency of such pottery in SP II is Plot 2B, which adjoins 3B to the South, and which was then a pig sty (Pilø 2007d:211). The high proportion of Frankish or Frisian pottery on Plot 2B seems to have come from a single broken *Reliefbandamphora* that was dumped there (Pilø, this vol. Ch. 10:303).

Although the preponderance of Frankish and Frisian pottery in building A301 is so high, the number of sherds is small (22). The trampling of sherds from a couple of broken Frankish or Frisian vessels could influence the proportion of sherds of this type greatly. But when one looks at the pottery in all of the layers of SP II on Plot 3B (132 sherds; Pilø, this vol. Ch. 10:Tab. 11), the trend is the same. The

Group	Building, Plot	Permanently occupied?	Pottery – area of origin						Unidentified grey ware		Total
			Continental		Danish		Slavonic				
			No.	%	No.	%	No.	%	No.	%	
SP I	1A	No	2	8	0	0	2	8	20	84	24
	3A/B	No	0		0		1		1		2
A	A303, 3B	Yes?	3	38	0	0	0	0	5	62	8
	A304, 3A	No?	2	13	0	0	3	20	10	67	15
	A406, 2A	No?	1		0		0		1		2
B	A200, 1A	Yes	3	9	6	18	4	12	20	61	33
	A301, 3B	Yes	11	50	1	5	0	0	10	45	22
	A302, 3A	Yes	7	18	0	0	7	18	24	63	38
Total			**29**		**7**		**17**		**91**		**144**

Table 16.2 *The distribution of the pottery in the occupation deposits and by area of origin, based upon Pilø's study of the material (this vol. Ch. 10, and database). Continental = Vorgebirge wares and shelly ware; Danish = grey ware with in-turned rims; Slavonic = grey ware with decoration of Slavonic type and/or out-turned rims. From both building A406 and SP I on Plot 3A/3B only two sherds were recovered and because of these low figures no percentages are given for these finds.*

proportion of Frankish and Frisian pottery remains 50%. Plot 3B stands quite apart from any other in the frequency of Frankish or Frisian pottery in SP II (with the exception of Plot 2B, noted here). The average amount of Frankish or Frisian pottery on the other plots in SP II is much lower, at only around 20%. The inhabitants of Plot 3B throughout SP II – which will include those who lived in building A303 – thus used much more Frankish and Frisian pottery than their neighbours. In the occupation deposits of building A303 too, all of the sherds with an identifiable provenance (3) are Frankish or Frisian types, but the total number of sherds (8) is too small for any great significance to be attached to this (Tab. 16.2).

In addition, Frankish glass beakers were used in building A301 more than in any other building excavated. As many as eleven sherds from three Sherd Families (Nos. 5, 12 and 13; Gaut, this vol. Ch. 9:Fig. 9.36, 9.37) were found in the building. The numbers of both the Sherd Families and the sherds are much higher than in any other building. The inhabitants of building A301 must have followed Frankish/Frisian drinking habits to a greater degree than those of the other excavated houses.

The clear signs of domestic occupation in building A301, together with only slight traces of craft activities, show that this was primarily a house, not a workshop (Skre, this vol. Ch. 15:411–12). The three everyday Frankish dress-accessories show that a woman from some Frankish or Frisian area was one of the inhabitants, and the frequent use of Frankish glass beakers and Frankish or Frisian pottery may show that the household included settlers from these areas. Considered along with the evidence for the use of silver as currency (Hårdh 2008; Pedersen 2008; Skre, this vol. Ch. 15:411–12), the identity of the inhabitants can be taken as an indication that, for a stretch of time, this building was the dwelling of a household with Frisian members who were trading with their homelands at a significant level – perhaps trading with Frisians in other Scandinavian and English towns. Kaupang's trade with the Frankish and Frisian lands was at its most intense in the period in question, and the residing of Frisians is recorded in many other northern European towns at this date, including Hedeby and Birka (Lebecq 1992; Wamers, this vol. Ch. 4:92).

The traded goods

What was being bought and sold in the transactions for which the residents of building A301 were responsible? From this building, imported items that could possibly have been goods for trade comprise one copper-alloy ingot weighing 4.6 g (C52519/14706), two mosaic eye beads and 37 further oriental beads (Wiker, in prep.), along with the glass beakers and pieces of amber already noted: altogether objects that more or less probably came from Frankish or Frisian lands (above, pp. 426–7). Both the bronze and the amber were most probably imported in order to be worked in Kaupang, and it is possible that the occupants of this building sold such materials on to the craftsmen within the town. The glass beakers may have been meant for trade even though they were manifestly also used by those who lived in this house.

Out of these imported trade goods, only the copper-alloy ingot is a type that has not also been found in other buildings. Both larger and smaller deposits of amber are known, but glass beakers are not known in such great numbers in any other building. The types of imported beads noted, by contrast, have been found in similar quantities in the two contemporary buildings excavated, A303 (2/37) and A200 (0/32) (Wiker, in prep.). Thus, compared with the other excavated buildings, it is only the ingot that is unique as an imported find, and only the glass-beaker sherds occur here in greater quantities than elsewhere. The diversity and the total quantity of imported goods nonetheless indicates that this building's residents had greater access to such goods than those who were living in the other houses excavated.

What local goods, though, could they have gained by trade for these imported items? Apart from what they needed for themselves, they presumably bought up goods to be freighted out on the same ships that had delivered goods from their own homelands. The fact that Frankish or Frisian traders were resident in Kaupang at all would seem to indicate that they wanted access to one or more of the local goods, which were considered attractive in their trading network.

One type of find occurs in strikingly large quantities in building A301, namely iron (Fig. 15.4). There is fully 2.2 kg per 10 sq m, more than four times as much as in any of the other five buildings excavated. The iron consists of a number of unidentifiable fragments together with 73 nails and 7 roves, either whole or fragmentary. Only these types of iron find are included in Figure 15.3, but a knife, a hook and an axe of Petersen Type A were also found in this building (C52519/38675, C52519/38724 and C52519/19467). The axe and the knife, and a large number of the nails and the rest of the iron, were lying in the northern side aisle of the building. If the weight of these artefacts had been counted together, the density of iron in the building would have risen to 4.1 kg per 10 sq m.

This concentration of iron artefacts and fragments is striking, and the high density in a building whose occupants appear to have had trade links with areas outside Scandinavia indicates that iron may have been one of the commodities they were trading in. Large-scale iron production can be demonstrated in several regions of Norway at this time (Skre 2008d:353–4), and it is reasonable to infer that the occupants of this building obtained these goods by trading locally.

It is not obvious, though, that iron was transported from Kaupang to the Frankish and Frisian lands. From the 8th century into the 10th century, iron production grew strongly in the North-West of the Frankish Empire (McCormick 2001:702–3; Butt 2002:990–1; Verhulst 2002:76–8). Although it is difficult to ascertain the volume of output there, or the level of consumption, one cannot see any clear need to either import iron into the homelands of the Frisians or into the rest of the north-western Frankish Empire.

Iron was being produced in other areas that may have received goods from Kaupang too, including Denmark (Buchwald 2005; Lyngstrøm 2008). Here, though, the use of Norwegian iron has also been demonstrated for much of the 1st millennium. Finds from Denmark show that, to a limited extent, Norwegian iron was imported in the form of bars although trade in finished products was probably more common (Buchwald 2005:239–41 and 292–316). Several sources show that axes were a commonly imported article. Twelve axes threaded onto a wooden rod have been found on a beach in Djursland. Thorvildsen (1951) dates these axes to the Viking Period and concludes that they had come from a stranded Norwegian merchantman (Buchwald 2005:309). In *Heimskringla*, in Chapter 250 of St. Olav's saga (*Óláfs saga ins Helga*), the story is told of how the Danish king Knut sent a message to his friend Kalf Arnasson in Trøndelag that he needed three dozen axes, corresponding to three rods of the kind that has been found in Djursland. That story is set in the mid-1030s.

Although iron was being produced in most of the areas to which Frisian merchants travelled, and in their homelands at a level that could have satisfied local needs, the iron that was available in Kaupang may still have been an attractive commodity for trade. Norwegian iron has a different chemical composition than the usual phosphoric iron on the Continent and was therefore less brittle and could be made into much better steel (Buchwald 2005:177–8 and 237).

It is reasonable to interpret the accumulation of iron items in building A301 – from which the residents had trading connexions with the Frankish and Frisian lands – as a stockpile of trading goods to be exported the next time a ship from the South came to the town. The inhabitants of the house probably obtained the iron goods in exchange for the goods they had imported from the Frankish and Frisian lands. To which other branches of the whole Frisian trading network the iron for export from Kaupang was sent is not a question that can be answered with any degree of certainty. Denmark would appear to be a possibility, but other areas within that trading zone could also be candidates. Besides the iron, the Frisians presumably also obtained trade goods that are difficult or impossible to trace archaeologically, such as furs and slaves.

The presence of Frisians

The house, building A301, was raised sometime in the 820s, and remained in use into the 840s. However there were people from the Frankish and Frisian territories in Kaupang both before and after that. Two of the five sherds of identifiable provenance from SP I are Frankish or Frisian, while the other three are Slavonic (Tab. 16.2). Although these are small numbers, they nonetheless show that there were people from those areas in the town in the earliest phase. In SP II the proportion of Frankish and Frisian pottery is 27% (N=951) and it reaches a peak in SP III at 62% (N=124). This indicates that Frisian settlers came to Kaupang throughout the first and into the second half of the 9th century. There are no intact deposits from the later phases at Kaupang, but the range of types from the later, disturbed contexts shows that the supply of pottery from Frankish and Frisian areas came to an end between 860 and 880 (Pilø, this vol. Ch. 10:303). Wamers (this vol. Ch. 4:91, Fig. 4.23) produces congruent datings for the items of metalwork; it appears that the supply of those thinned out and then ceased in the second half of the 9th century.

This view is in good agreement with the development of the Frisian North Sea trade, which reached a peak in the period c. 770–830 and then fell dramatically away after the abandonment of Dorestad around the year 860 (Lebecq 1992). Two of the 9th-century Frankish dress-accessories that have been found in graves at Kaupang are from burials that can be dated on other grounds to the 10th century (Ka. 126 and Ka. 259). This may suggest that the successors of the 9th-century Frisian settlers continued to live in Kaupang into the 10th century. The woman in grave Ka. 259, who had no jewellery of Scandinavian type at all, was buried with a soapstone cooking vessel. The adoption of Scandinavian cooking practices can perhaps be viewed as the result of cultural hybridization, and possibly becuse the connexion with the Frankish and Frisian lands had become weak in the woman's lifetime, making the supply of Frisian cooking vessels poor.

Frisian settlers in Kaupang must also have died in the 9th century. Of the 204 documented graves out of the postulated 1,000 burials (Stylegar 2007), only those two mentioned can be identified as probably being Frisian, on the basis of their grave goods. What happened to all the rest?

When Kaupang was in operation the Frisians were Christian, and ought to have been buried therefore in consecrated ground. However, no separate cemetery with burials carried out according to Christian practice has been found at Kaupang, and although priests may have visited, they can hardly have stayed there for longer periods. For a Christian community that had to bury a co-religionist there were, then, two options: they could either undertake a funeral as necessary, in which they themselves performed the Christian burial rites, or they could transport the remains of the deceased – meaning the bones after the removal of the soft tissues – to the homelands to be buried there.

The second option could hardly be traced archaeologically, but there may be signs of the first. In the cemetery of Søndre Bikjholberget some graves have been found which could be the pragmatic burials of Christians. It makes sense to look for graves that display common features of Christian burial practice in the Frisian homeland: unburnt burials in coffins, oriented E.–W., and graves with few if any grave goods. One should not expect a complete absence of grave goods, as graves with normal personal accessories, for example, a knife and a buckle, were common in the Frisian lands (Wamers, this vol. Ch. 4:90).

There are a number of graves at Kaupang that show these features, although only in four cases do all four co-occur in the same burial. These are four coffined inhumations: three in rectangular coffins (Ka. 318–20) and the fourth (Ka. 314) in a trough-sled (Stylegar 2007:89–90). Three of these are aligned SE.–NW. (Ka. 314, 319 and 320), while the other is aligned NE.–SW. (Ka. 318). All of them have few or no grave goods: just a knife (Ka. 318), one glass bead, uncertainly associated with the grave (Ka. 318), and a wooden cup (Ka. 320). Three of the four lay together at the far West of the area of excavation, while the remaining grave (Ka. 314) was situated 7 m further east (Stylegar 2007:fig. 5.6).

It is especially the three burials in rectangular coffins, which are the three that lay together, which stand out as possible pragmatic Christian graves. Amongst the communities that can be identified in Kaupang at this date, it was only the Frisians who practised Christian customs, meaning that the deceased in these four graves could therefore have been Frisians.

16.4.2 Settlers from the western Slavonic regions

Neither in the graves nor in the settlement area have any items of metalwork from Slavonic areas been found. The only type of personal possession that definitely comes from those regions is pottery. The predominant type is the Feldberg type, although Sukow and Menkendorf pottery is also present (Pilø, this vol. Ch. 10:297). These forms imply that the Slavs who came to Kaupang were from the area around and in Rügen, in the eastern part of Mecklenburg and Pommerania (Brather 2004b:320). These were the western Slavonic areas that lay closest to Skåne and the Danish islands.

Grey ware accounts for a very high proportion of the pottery found in Kaupang (56%: 2,975 out of 5,309 sherds), but attempts to distinguish between Slavonic grey wares and others run into methodological difficulties (Pilø, this vol. Ch. 10:296–300). On the evidence of decoration Pilø has been able to pick out a number of sherds that are definitely Slavonic, while a further quantity can be identified as very probably Slavonic on the basis of the rim profile (an out-turned rim; Pilø, this vol. Ch. 10:297–8 and 300). Within the large collection of grey ware, some sherds with an in-turned rim can also be identified as probably from southern Scandinavia (i.e. present-day Denmark and Skåne).

Both certain and probable Slavonic sherds occur as early as SP I, and continue through SP II and SP III into the second half of the 9th century. There are no 10th-century forms amongst the certain and probable Slavonic sherds identified by Pilø (this vol. Ch. 10:303, Tabs. 10.6 and 10.9). This may show that no Slavonic settlers or visitors came to Kaupang in that century.

Slavonic pottery is found in occupation deposits from buildings A304 and A302 on Plot 3A, and also in A200 on Plot 1A – in each case making up 12–20% of the assemblage (Tab. 16.2). In the two buildings on Plot 3A there is also Frankish/Frisian pottery in equally large quantities. In A302 there were also sherds from a soapstone vessel, so cooking was done in vessels of western Scandinavian, Slavonic and Frankish/Frisian provenance alike.

Slavonic pottery thus occurs in all of the Site Periods and in the occupation deposits of three out of six buildings. The presence of Slavs appears to be well attested through the 9th century but they seem to have been absent in the 10th century. In SP I and at the beginning of SP II (A304; Tab. 16.2) this presence would seem to have been seasonal in character. The presence of Slavonic pottery in two buildings of the second quarter of the 9th century (A200 and A302; Tab. 16.2) shows that Slavs were there at that time also, although the dominant presence in both buildings of cooking vessels from non-Slavonic areas also argues against permanent Slavonic occupation of either building. They may rather have been "guests in the house", to use the title of Mats Roslund's dissertation on the presence of Slavs in Scandinavia in the Viking Period and early Christian Middle Ages (2007). He writes (2007:232–3 and 249) that in the earliest phase Slavs were brought in as slaves, but that they also came as craftsmen and traders to places where they found protection: in other words at trading sites and within households. It was also the practice to take foreigners into the household in Continental and southern English towns at this time (Middleton 2005), and it may be such a practice that is reflected in the finds of pottery in these two buildings. This does not, of course, exclude the possibility that Slavs were permanently resident in other parts of the town, or on the excavated plots after c. 850.

16.4.3 Settlers from Scandinavian regions

As noted, it would appear that there may be a few Christian burials at Kaupang. But the great majority of the 204 graves excavated are clearly Scandinavian, not only in the style of burial but also in the grave goods. There are great, partly regional differences in Scandinavian burial practices, and the wide range of variation in such practices at Kaupang (Stylegar 2007:99–101) indicates that there were people from a wide range of different parts of Scandinavia buried here.

A number of the types of object found in Kaupang were produced in Scandinavia, and the following section includes a discussion of those whose origin can be located to particular regions within this huge area. The discussion is based upon the groups of material rather than being structured regionally, as the sections above. Conclusions are drawn concerning places of origin for each group of material, and an interpretation presented of what this geographical distribution reveals about the settlers in and visitors to Kaupang. Finally all of these separate observations are drawn together.

When particular Scandinavian artefact-types are essentially found also in other, limited, part of Scandinavia, this is presumably a function of the way in which the production and distribution of these objects was carried out: they were produced by craftsmen within that area and distributed through channels that did not extend beyond that area. What one cannot suppose, however, as was the case with the Slavonic and Frankish or Frisian objects above, is that the use of the items was limited to individuals who were from such areas because of the ethnic significance of the items and customs of dress etc. Although one can demonstrate a wide range of variation in customs of dress and armament between various parts of Scandinavia (Svanberg 2003; Stylegar 2010), these customs would hardly prevent people from using weaponry and jewellery that were unusual in the immediate area but more common in other parts of Scandinavia. Indeed it would be reasonable to expect precisely such behaviour in a place like Kaupang.

Consequently, when objects from specific areas of Scandinavia are identified at Kaupang, it cannot be supposed that those who possessed them were themselves from the areas in which the items were produced and where they were usually in use. Thus, if there were dress-accessories that are primarily found in eastern Scandinavia amongst the finds from Kaupang, they could just as easily have been brought to the town by Kaupangers who had travelled to the Baltic as they could by an eastern Scandinavian who had either visited or settled here. Therefore, these items provide rather evidence of which areas the settlers of and visitors to Kaupang journeyed through at various times. Kaupang was, moreover, a significant place of production for some of the artefact-types in question, and one must allow for the possibility that some of them may have been manufactured here.

Jewellery and weights

Metal dress-accessories occur in graves and in the settlement throughout the functioning life of the town, while the types of weight in question appear from 860/70 onwards. From the investigations in the settlement area of 1998–2003, there are 60 Scandinavian mounts and dress-accessories, including 28 of silver and 32 of copper alloy (Hårdh, this vol. Ch. 3; Graham-Campbell, this vol. Ch. 5). Earlier finds of such jewellery in the settlement area and cemeteries, published by Blindheim and Heyerdahl-Larsen (Blindheim et al. 1981; Blindheim and Heyerdahl-Larsen 1995; Blindheim et al. 1999) will also be included in the discussion, in which case figures are given for the specific types in question.

Although they can be more frequent in some regions rather than others, many of the types of metal dress-accessory occur over much of Scandinavia (Callmer 1984a, 1995b; Hårdh, this vol. Ch. 3:30–5), making it difficult to identify definite areas of origin. Some types, however, are regionally more limited, and some of these also appear at Kaupang in quantities that allow one to observe chronological and geographical trends. This is the case with the equal-armed and trefoil brooches, and with penannular brooches. These three groups are discussed below. Oval ("tortoise") brooches are also numerous at Kaupang (62 brooches from 31 graves), but the dominant types Petersen 37 and Petersen 51 (36 and 15 brooches respectively) are found in great numbers over most of Scandinavia (Blindheim et al. 1999:29–31; Skibsted Klæsøe 1999:114). There are three oval-brooch fragments and a mould impression from the settlement, but none of these can be classified.

Twenty-one equal-armed brooches have been found at Kaupang, nine of them in 1998–2003 (Hårdh, this vol. Ch. 3:36–43; Wamers, this vol. Ch. 4:76–8). The other twelve were produced by earlier excavations, seven in graves and five from the settlement (Blindheim et al. 1999:31–2). Six of these twenty-one are Continental types (Blindheim et al. 1999:31–2; Wamers, this vol. Ch. 4:90–2), and these are discussed above (p. 430).

Of the remaining fifteen equal-armed brooches, eleven date from the period before 850 (Types 1 and 2: Skibsted Klæsøe 1999) and four to the following period (Types 3 and 4). Of the eleven from the earlier period, nine are of Skibsted Klæsøe's Type 1, which has a primarily southern and eastern Scandinavian distribution.[1] Type 2 appears to be a common type in western Scandinavia – in other words in present-day Norway – during the same period, but only two specimens have been found at Kaupang, both in graves.[2]

In the first half of the 9th century, then, there is a marked predominance of equal-armed brooches of southern and eastern Scandinavian type at Kaupang over the type that occurs during this period in western Scandinavian areas. The same trend is apparent amongst the types of trefoil brooch from the first half of the 9th century (Skibsted Klæsøe's Types 1 and 2). Of a total of eleven equal-armed brooches from Kaupang (four from the settlement area and seven from graves), four date to the first half of the 9th century. Three of these are of Type 1 and the other of Type 2. Both of these types are found primarily in Denmark and Skåne.[3]

The distribution of brooch-types that occur at Kaupang is rather different in the following period, c. 850–930. Of the seven trefoil brooches from this period, five are of Type 3 and two of Type 4. Type 3 has its main distribution in Norwegian lands, while Type 4 is mostly found in Danish territory. One of each of these types is from the settlement and the other five are from graves.[4] Thus in the later period (850–930), the trefoil brooches from Kaupang are clearly more similar to the rest of Norway than in the earlier period, although southern Scandinavian types are still present.

When one looks at the distribution of the types that the four equal-armed brooches of the later period represent, this picture is both repeated and developed. In other parts of Norway the equal-armed brooch goes out of use in the second half of the 9th century, and this brooch type will not reveal contacts in that direction. But in southern and eastern Scandinavia they were still in use, and at Kaupang there are four equal-armed brooches from this period, three of Skibsted Klæsøe's Type 3 and one of her Type 4.[5] These types are found primarily in Denmark and Bornholm, and at Birka and in its hinterland (Uppland).

The casting models from Kaupang identify some of the brooch-types that were manufactured by the metalcasters in the town. Pedersen's studies of these

1 Ka. 267b, A-sjakt (Trench A) 1963, MO 66e, C52517/926, C52517/2050, C52516/3880, C52517/2089, C52516/4095 and C52517/254; Hougen 1993:pl. 25:3; Blindheim and Heyerdahl-Larsen 1995:pl. 59; Hårdh, this vol. Ch. 3:36–43, Figs. 3.4–12.

2 Ka. 250c and Ka. 299p; Blindheim et al. 1981:pl. 65; Blindheim and Heyerdahl-Larsen 1995:pl. 18; Skibsted Klæsøe 1999:103, figs. 9–12; Hårdh, this vol. Ch. 3:37.

3 Ka. 316n and Ka. 250g, MO1960/847, C52517/1459; Blindheim et al. 1981:pls. 41 and 85; Blindheim et al. 1999:33, fig. 6; Hårdh, this vol. Ch. 3:43–7, Fig. 3.13; Skibsted Klæsøe 1999:103–7, 2001).

4 Ka. 286b and c, Ka. 291b and Ka. 294b, A-sjakt (Trench A) 1962, Ka. 406b, C52516/4101; Blindheim et al. 1981:pls. 1 and 80; Blindheim and Heyerdahl-Larsen 1995:pls. 1 and 84; Blindheim et al. 1999:33–4, figs. 7–8; Hårdh, this vol. Ch. 3:43–7, Fig. 3.14; Skibsted Klæsøe 1999:103–7, 2001).

5 Ka. 303b, Ka. 254b1, Bryggen 67, C52517/779; Blindheim et al. 1981:pl. 78; Blindheim and Heyerdahl-Larsen 1995:pl. 22; Hårdh, this vol. Ch. 3:40–2, Fig. 3.10, 3.12.

models show that only southern Scandinavian types of equal-armed brooch were produced both before and after 850. She also shows that trefoil brooches were being made, but the types are unidentifiable (Pedersen, in prep.).

With the knowledge we have of their production, the metalcasters of Kaupang do not appear, therefore, to have been making types that were usual in the rest of western Scandinavia, but rather types that were usual in the South and East. Some brooches of types whose principal distribution lies to the North and West of Kaupang are found here all the same, both in the earlier period (two equal-armed brooches of Type 2 out of eleven equal-armed brooches from this period), and in the later period (five trefoil brooches of Type 3 out of seven trefoil brooches from this period): seven brooches altogether. Apart from one trefoil brooch of Type 3, all of these western Scandinavian brooches were found in graves. In the settlement, the southern and eastern Scandinavian brooches are utterly predominant both before and after 850 amongst the metalcasters' models and the brooches alike. Since the western Scandinavian types do not seem to have been manufactured at Kaupang, it seems likely that these were brought here by those individuals who were buried with them. As the proportion of western Scandinavian brooch-types in the graves is higher after 850, it may be inferred that the immigration of people from western Scandinavia was at a higher level post-850 than before.

There are no types of weight from the earlier period that can be assigned to particular regions. After 860/70, however, cubo-octahedral and oblate spheroid weights of copper alloy and iron were produced in eastern Scandinavia, 47 and 23 of which respectively have been found at Kaupang (Pedersen 2008:tab. 6.4). There are also two grave finds of balances from this period that are most probably of eastern origin (Ka. 6 and Ka. 8; Pedersen 2008:126). The weights and balances are found first and foremost around the Baltic: in south-western Finland, around Mälaren, on Gotland, in eastern Denmark and in smaller quantities along the Russian watercourses (Steuer et al. 2002:Abb. 4). They must have been brought to Kaupang by people who had been staying and trading in these areas. Those may have been visitors to Kaupang, new settlers, or Kaupangers themselves who travelled to eastern Denmark or further east on trading expeditions. All three of these possibilities show that Kaupang was involved in the south-eastern and eastern Scandinavian trade network from the middle of the 9th century.

Is it possible, then, to judge whether Kaupang's contacts with southern and eastern Scandinavia fundamentally were directed to the South, or whether they also stretched further towards the Baltic? The only type of personal possession that has a clearly eastern rather than both an eastern and southern Scandinavian distribution is the terminal knob of a penannular brooch of which two were found in the settlement area 1998–2003 (C52517/70, C52519/15513; Graham-Campbell, this vol. Ch. 5:104–6, Figs. 5.8–9).

These are the only definitely eastern Scandinavian finds. Three complete penannular brooches have been found in graves (Ka. 8, Ka. 272 and Ka. 278), but these are identified by Heyerdahl-Larsen (1979a; also Graham-Campbell, this vol. Ch. 5:105), as a southern Norwegian variant that may have been manufactured at Kaupang. The richly furnished woman's grave Ka. 254, with spirals, beads and a copper-alloy chain of Finnish types (Blindheim et al. 1981:219–20, pls. 77–9, 1999:54; Stylegar 2007:84, fig. 5.13), also included clearly western Scandinavian artefacts. The Finnish objects thus cannot identify the lady's area of origin. No types of pottery emenating definitely from eastern parts of Scandinavia have been identified at Kaupang.

It seems likely that the lack of pottery and the low number of distinctly eastern Scandinavian dress-accessories show that people from eastern Scandinavia were not amongst those who settled at Kaupang, and that the contact between Kaupang and the trading network around the Baltic was essentially concerned with the south-western area of that network: the Danish lands, and perhaps Hedeby in particular.

Pottery: a Dane's house

A200 is the only building in which southern Scandinavian pottery, from the area comprised by the medieval state of Denmark (now Schleswig, Denmark and Skåne), occurred in any substantial amount. Six of the thirteen identifiable sherds are southern Scandinavian; the remainder are Slavonic or Frankish/Frisian (Tab. 16.2). Almost as striking as the high proportion of southern Scandinavian pottery in this building is its near total absence from other buildings. That may be due, however, to the great difficulties involved in identifying southern Scandinavian pottery amongst the grey wares. Only rim-sherds can be identified, and this is why only 152 of the 2,975 sherds of grey ware (5%) can be identified as southern Scandinavian. It is then all the more striking that southern Scandinavian rimsherds make up fully 20% of all the grey ware from building A200, four times more than in the assemblage as a whole. This means that there is good reason to believe that a high proportion of the unidentified grey ware from A200 (20 sherds) is also from southern Scandinavian vessels.

A200 is a house that was permanently occupied. It seems clear that the inhabitants were a pottery-using household, and the high proportion of pottery from Danish territories indicates that this is where they were from. The other pottery could be the product of "pragmatic use" (Pilø, this vol. Ch. 10:288), or of the temporary presence of foreigners in the household. The occupation deposits from this building do not include any finds that provide clear indications of the activities of its occupants, but the large quantity of finds associable with amberworking by the standards of Kaupang may agree nicely with the assumed southern Scandinavian origin of these people (Resi, this vol. Ch. 6; Skre, this vol. Ch. 15:409).

Wamers (this vol. Ch. 4:93) noted an accumulation of Insular artefacts on Plot 1A. As noted above (p. 440), these were probably brought to Kaupang by Scandinavians who had been in Britain and Ireland, and perhaps especially in the Irish Sea area. The concentration of Insular objects on this plot is consistent with the hypothesis that it was occupied by people from Danish territories.

Soapstone objects: a Northman's smithy?

Amongst the objects of soapstone, it is important to distinguish between cauldrons, which will mostly have arrived as traded goods, and other artefacts, which seem to have been brought in as personal possessions (above, p. 424, Tab. 16.1). The other artefacts include spindle-whorls, sinkers, loomweights and tuyères (Baug, this vol. Ch. 12; Øye, this vol. Ch. 13:243–51). The geographically diverse sources of these items indicates that, unlike the cauldrons, these came to Kaupang over various routes, many of them presumably carried by their users, either as finished articles or as raw material for reworking. Soapstone occurs in the western parts of Scandinavia, primarily in what is now Norway.

The first point to note is that not a single fragment of soapstone, worked or unworked, can be assigned to SP I. In comparison, SP II has 25 vessel sherds, 3 spindle-whorls, 5 tuyères and 35 other fragments. Although SP I was much shorter than SP II, and settlement then was only seasonal, this is a contrast that must be regarded as significant. There is, however, no reason to interpret it in terms of an absence of anybody from western Scandinavia in SP I. The use of soapstone vessels was not widespread at the beginning of the 9th century, increasing only as the century progressed. Soapstone vessels were also heavy, and alternative methods of cooking may have been preferred by travellers staying for a shorter period. Large quantities of scorched stone are recorded from SP I at the lower edge of the plots (Pilø 2007d:194–5, figs. 10.2 and 10.4). These stones are detritus from cooking in wooden vessels or leather bags using heated rocks, a method that was common in Scandinavia from the 7th century onwards, especially in the western areas.

No definite or even probable types of Scandinavian grey ware have been identified from SP I, but this is presumably due to the fact that finds of pottery are few, and the proportion of such pottery in the overall assemblage is low (Pilø, this vol. Ch. 10:300). The scope for saying anything on which visitors were the most numerous amongst those who were temporarily resident on the plots of Kaupang around the year 800 is small, but it seems reasonable to conclude that the proportion of Slavs and Frisians or Franks amongst them was not insignificant.

The large number of soapstone items from SP II, and especially of sherds of cauldrons, confirms that people from western Scandinavia were then resident in Kaupang. The quantity of sherds in occupation deposits is low, and indeed they are found only in building A302; here, however, there are four sherds and one small fragment. The quantity of pottery from this building was also large (Skre, this vol. Ch. 15:Fig. 15.3), and that which is identifiable consists of equal amounts of Slavonic and Frankish or Frisian pottery (Tab. 16.2). This building was permanently occupied, and the heterogeneous picture may mean that several households were in residence during the functioning life of the building, and possibly that soapstone cauldrons were used by inhabitants from outside of Scandinavia, a possibility that has been discussed above (p. 422).

Most of the large group of unidentified soapstone fragments, which accounts for 34% of the soapstone finds (280 out of 806), are relatively small (<5 cm). Many of them are probably pieces of broken artefacts whose outer surfaces had flaked apart. Some fragments, however, are so large that they cannot have been produced in such a way, but were probably brought into Kaupang as raw material out of which small artefacts could be made.

A large fragment of this kind was found in building A406. This piece weighs 60 g and may have been intended for a spindle-whorl. A406 is otherwise a house with few finds or traces of activity. It is was probably used as a house and smithy under temporary occupation (Skre, this vol. Ch. 15:408–9). The almost total absence of pottery in the occupation deposits (Tab. 16.2) suggests that the building was not used by people from southern Scandinavia, the Continent or Slavonic areas. It is possible, by contrast, that the piece of unworked soapstone indicates that people from western Scandinavia were those who most frequently resided here. This hypothesis fits nicely with the fact that this building seems to have been used as a smithy. As already noted (above, p. 432–3), it is reasonable to suggest that access to iron was one of the reasons why traders from southern Scandinavia and the Continent travelled to Kaupang, and this building may have been one site where artefacts for sale to such customers were produced.

Scandinavians at Kaupang

Equal-armed and trefoil brooches of Scandinavian types show that in the first half of the 9th century Kaupang had more contacts with areas of Denmark and southern Sweden than areas of Norway. In this context, contact was a matter of the movement of people: both settlers and all sorts of visitors, and Kaupangers who travelled out and brought goods back with them. The fact that the metalcasters in Kaupang produced only brooches of southern and eastern Scandinavian types shows that they were amongst the settlers from those areas.

In the case of Scandinavian pottery, it is only ceramics from Danish territories that can be identified in Kaupang. In SP II there is a considerable concentration of these in building A200, and this house therefore seems to have been permanently occupied by a household of Danish origin. This agrees well with the evidence of the metal dress-accessories for extensive contact with Danish lands in the first half of the 9th century, a contact that thus appears also to have included the settlement of people from that area.

A good supply of western Scandinavian types of equal-armed brooches in graves of the first half of the 9th century indicates that there were people from those regions settled in Kaupang too. Objects of soapstone from SP II were probably brought to Kaupang by such people. The absence of such items from SP I is not evidence to the contrary but probably reflects the fact that the settlers then were only present for certain periods of time and opted for more practical methods of cooking in light vessels using heated stones.

Metal dress-accessories and weights show that after the middle of the 9th century contact with all parts of Scandinavia was strengthened, including the West. Pottery provides no evidence of this, but it is possible that the presence of soapstone cauldrons in graves does. As Stylegar has pointed out (2007:80–1), the deposition of soapstone cauldrons is much more frequent towards the end of the functioning life of Kaupang, in the 10th century. This change took place at Kaupang and in Vestfold just as it did in the rest of western Scandinavia. The fact that this development in burial practice at Kaupang agrees with the rest of western Scandinavia shows that the town in that period had greater contact with those regions than would appear to have been the case earlier in its history.

Since there are quite major differences in burial practice in the various parts of Scandinavia in the Viking Period, the styles of burial at Kaupang could indicate which areas of Scandinavia the deceased had come from. The two largest and most fully investigated cemeteries at Kaupang, Nordre Kaupang and Bikjholberget, each had its own rite: the former with cremations under barrows, the other with inhumations under level ground. In the much smaller cemetery of Søndre Kaupang there are also cremations under barrows while at Lamøya and Hagejordet the two rites are mixed. There are further differences too, such as the very high proportion of boat graves at Bikjholberget (Stylegar 2007:68–78).

It is, however, no straightforward matter to associate burial practice with geographical areas. The systematic differences between some of these cemeteries probably show that different groups from the population of the town buried their dead in different locations. But the differences between the burial areas may, in addition to being influenced by the usual burial practices in the home areas of the dead, derive from social or religious differences in the town (Stylegar 2007:99–101).

All the same, it is reasonable to suggest that the majority of those interred in the cremations under barrows in the cemeteries of Nordre and Søndre Kaupang came from westerly parts of Scandinavia, where cremation was the predominant rite in most areas in the Viking Period – as in Vestfold, where the proportion is 75–80%. Inhumations under level ground are, however, almost the only form in the majority of Danish areas, with the exception of North Jutland (Stylegar 2007:87). It seems reasonable to believe that the Danes buried their dead at Bikjholberget, while people from western Scandinavia, those whom Ohthere referred to as Northmen (from *Norðmanna land*, "the land of the Northmen"; Bately 2007:46 and 54), were interred at Nordre and Søndre Kaupang, as well as on Lamøya and at Hagejordet. In western and northern Norway there are relatively high levels of inhumation in some areas, producing a picture that fits with those two cemeteries.

All of these cemeteries were probably in use throughout the functioning life of Kaupang. The large number of graves in the two best investigated cemeteries, c. 160 at Bikjholberget (Stylegar 2007:77) and c. 200–300 at Nordre Kaupang (Skre 2007f:375), shows that both groups were present in large numbers, although the uncertainties over both the numbers and the premisses makes it impossible to undertake any more precise calculations of how high a proportion of the population either group formed at various times. It is also quite possible that the cemetery at Nordre Kaupang was not for the population of the town but rather for the petty king of Skiringssal, his men and their households (Skre 2007f:283).

The types of personal possessions that have close parallels in eastern Scandinavia – metal dress-accessories and weights – are also well represented in Danish lands, which is also where the pottery comes from. It is possible that Kaupang's contacts with the zone in which these dress-accessories and weights occur, were largely with the Danish areas and only to a minor degree directly with the Baltic region.

Figure 16.1 *The lines on these maps show both the general areas from which Kaupang's settlers originated and the town's trading connexions, in the two periods c. 800–850/70 and c. 850/70–930.*

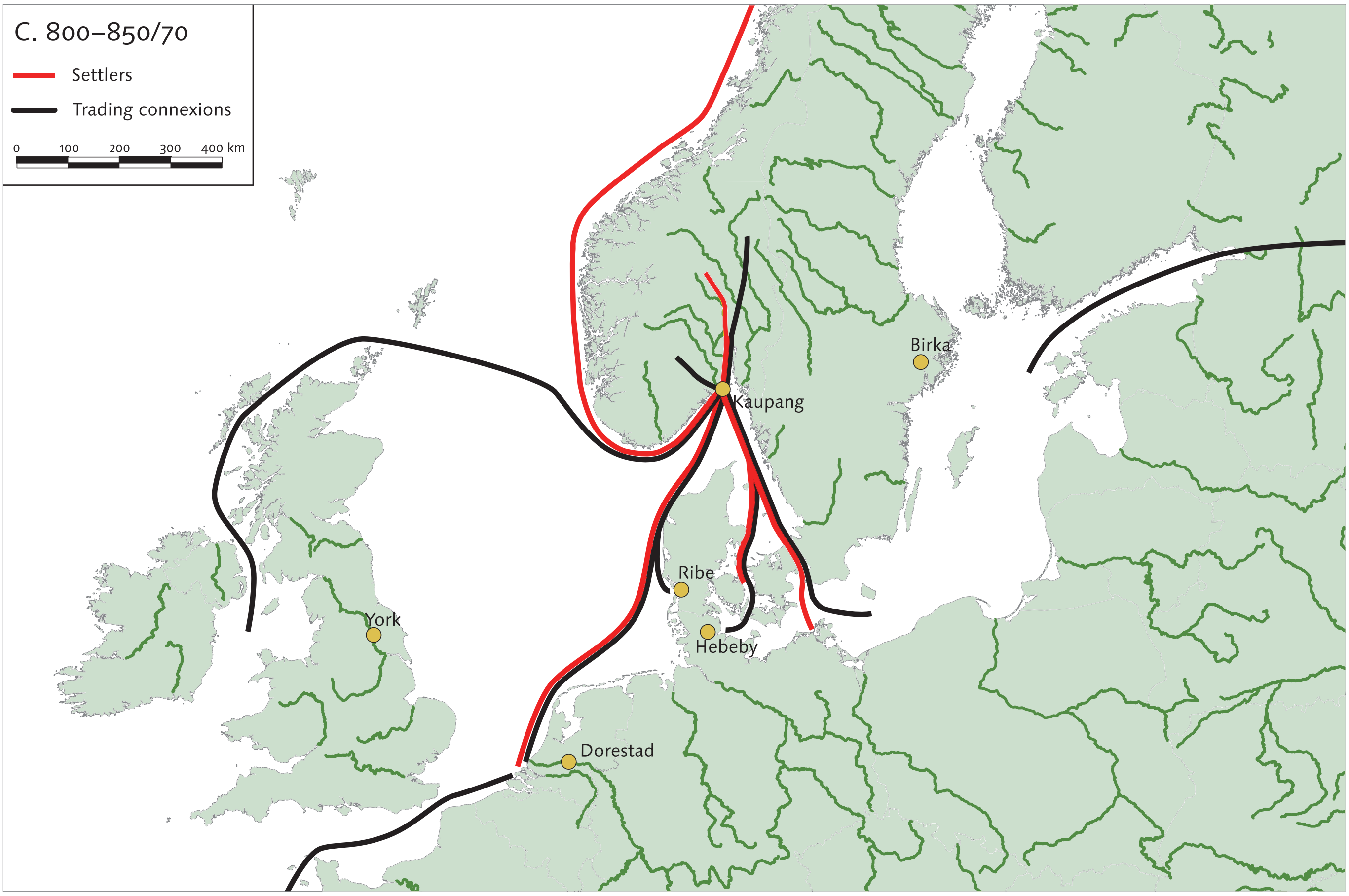
16.4.4 Who brought the items from the lands around the Irish Sea?

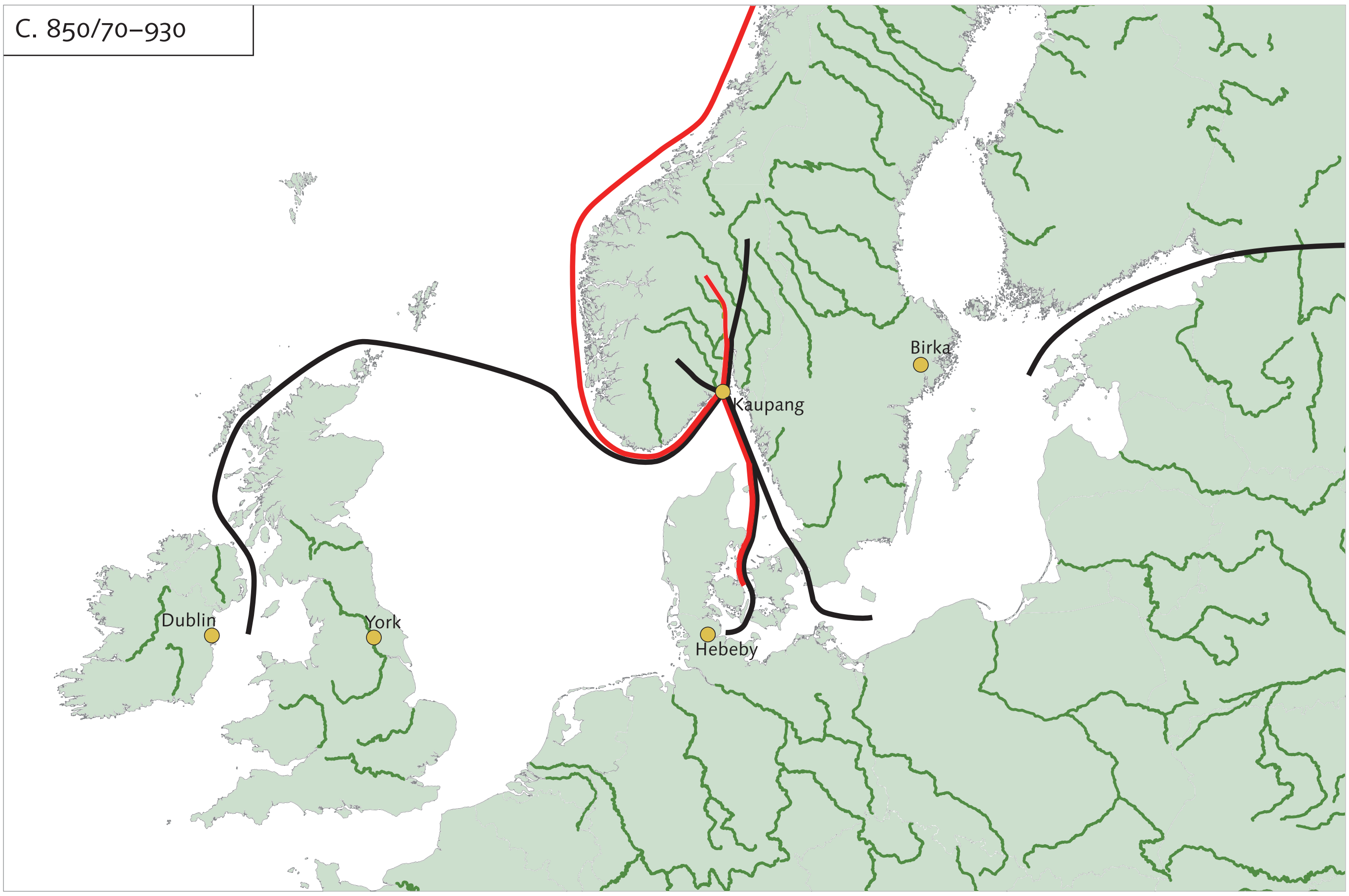
From the settlement area, there are also several pieces of personal property that can be traced back to Insular regions. These comprise ten items of metalwork, most of them fragments of mounts and brooches dating to the 8th and 9th centuries (Wamers, this vol. Ch. 4:80–7, 92–7). A total of fourteen Insular objects have been found in graves, and the range here is rather different. Here too the number of mounts is, at eight, high; but in contrast to the settlement finds the remainder are various kinds of practical equipment (buckles, needlecases, drinking horn mounts, possible page-turners, and a bronze bowl). These artefacts are found in graves that date throughout the history of Kaupang, including the first half of the 10th century (Ka. 279 and Ka. 298).

As Wamers stresses (this vol. Ch. 4:93), the great majority of the items of Insular metalwork from Kaupang and elsewhere in Scandinavia, both from graves and from settlements, have been re-worked into items of jewellery, weights and so on. Only a few items of practical equipment retained their original function. Unlike the majority of their Continental counterparts, the Insular dress-accessories from the site are highly fragmented. The low number of Insular pieces, the high level of re-working into Scandinavian forms of dress-accessory and weights (Pedersen 2008:170–6), and the absence of whole pieces with significance as markers of ethnic identity, indicate that people from the Irish Sea zone did not visit or reside in Kaupang to any appreciable extent. It seems reasonable to conclude, along with Wamers (this vol. Ch. 4:95–7), that the items of Insular metalwork were goods obtained for the most part by plunder rather than trade, and then brought by Scandinavians to Kaupang.

It could be argued that the identification of a few signs of the re-working of jet-like material, including raw material of a quality and size that were well suited for beadmaking (Resi, this vol. Ch. 6:123–7; Plahter, this vol. Ch. 7), supports a case that there were craftsmen from some Insular area in Kaupang. But the qualities of this material are little different from those of amber, and it would have been quite feasible for the amberworkers of Kaupang to have made items of jet. An Irish lead model of the 9th century for the manufacture of glass jewellery has also been found (C52517/635; Pedersen, in prep.), but there is no other evidence that advanced glassworking like this was practised in Kaupang and it seems more likely that it was brought as a curiosity.

The occurrence of Insular artefacts at Kaupang is therefore evidence that, amongst the Scandinavians who lived at and visited the town, there were some who also participated in the traffic to the Insular areas, perhaps particularly the lands around the Irish Sea. There, they would also have been involved in acts of war, and some of the spoils of those expeditions came to Kaupang. Some of them were then handed to metalcasters for re-working or to be broken up into scrap metal. The re-worked dress-accessories and practical items went with their new owners, mostly women, into the grave. This supply of personal possessions from Britain and Ireland seems to have carried on throughout the functioning life of Kaupang, which is congruent with the chronological range of traded goods from those areas.


C. 800–850/70
Settlers
Trading connexions
0 100 200 300 400 km
Kaupang
Birka
Ribe
York
Hebeby
Dorestad


C. 850/70–930
Kaupang
Birka
Dublin
York
Hebeby

Kaupang: between East and West; between North and South

17

DAGFINN SKRE

In this final chapter, certain key threads from the concluding chapters of both the present and the previous two volumes in the Kaupang series are drawn together. From Volume 1 comes the political perspective: Kaupang was founded by the king of the Danes, close to the northern border of his realm and in Skiringssal, the central place of a dynasty of petty kings, the Ynglings. From Volume 2 comes the economic perspective: the economy of Scandinavia expanded in the 8th century. Through greater craft production, the establishment of market sites, and both the plundering of and trade with areas outside of Scandinavia, many trade goods became available to a wide population, not just the elite as hitherto.

These two threads are plied together with those that have been spun out in chapters 15 and 16, which deal with activities and identities amongst the visitors to Kaupang and the settlers of the town, and with their trading links.

The two political motives that the Danish king had for founding Kaupang were probably to consolidate his kingdom against growing Frankish pressure and to protect it against pirates from the coasts of western Scandinavia. His economic motives are also considered to have been two: access to goods from western Scandinavia and control of navigation to the British Isles, especially to Ireland. Objects from the Irish Sea zone found at Kaupang show contact from the earliest phase of the town onwards, and it must have been Scandinavians who were responsible for these contacts.

The fact that Kaupang belonged politically to southern Scandinavia is very clearly shown by the trade routes and the origins of the inhabitants in the first half of the 9th century. Goods and people from Frisian and Slavic lands must have arrived via the Danish waters and territories, and the presence of southern Scandinavian settlers, including craftsmen, can be traced. There were, however, visitors and inhabitants from western Scandinavia too.

In the second half of the 9th century the Frisian trade came to an end, probably because Dorestad had been abandoned, and Slavs gradually stopped coming to Kaupang too. However contact with the Irish Sea zone not only continued but strengthened, a phenomenon that agrees nicely with the fact that at the end of the 9th century Kaupang became part of the westerly-oriented Norwegian kingdom. Kaupang also maintained and intensified its participation in the Baltic trade, which was flourishing in this period. The currency that was used in that zone, silver and specific types of weight, occur in great quantities at Kaupang, but are much less frequent elsewhere in western Scandinavia.

In the second half of its functioning life, down to c. AD 930, Kaupang thus lay in a border region between a western Scandinavian economy lacking market sites and a silver currency and a southern and eastern Scandinavian economy that involved silver, markets and towns. The economic and social differences between these two zones probably had roots right back to the beginning of the 1st millennium AD, and can be traced onwards as far as the Late Middle Ages.

In the two immediately preceding chapters, three topics have been discussed which together portray various features of the life of the town: the activities that the inhabitants of Kaupang were engaged in, where the people had come from when they settled in the town, and which areas they maintained trading links with. In this final chapter, these three topics will be placed into some of the contexts that have been examined in the previous volumes in this series (Skre 2007a, 2008a). Those contexts are first outlined (17.1), after which the two main phases of the history of the town are discussed: the first half of the 9th century (17.2) and then the period down to the abandonment of the town around the year 930 (Skre 2008e:200), (17.3). As there are preserved stratified deposits only from the earlier of those periods, and the settlement activities and chronology of that period are therefore much better known, there is inevitably most to say about this phase, while the second phase has to be treated more sketchily.

17.1 Kaupang's contexts

The political context

In earlier contributions to this series, it was argued that the foundation of Kaupang should be seen in connexion with two political entities, of which the first was the central place of Skiringssal, established by the dynasty of petty kings, the Ynglings, in the mid-8th century, and which rapidly became the most important political, religious and juridicial centre in Viken. The foundation of Kaupang is also to be associated with a period of expansion for the Danish kingdom between the late 8th and the mid-9th century (Skre 2007i; 2007j).

The central place of the Yngling dynasty should be regarded as a condition leading to the choice of this site, rather than as the immediate reason for the foundation of the town. The presence of a powerful family of petty kings provided the political, military and ideological protection that a town needed (Skre 2007j:450–2). With large numbers of people coming to assemblies at the site, probably three times a year (Skre 2007g:400), craftsmen had the quantities of customers they wanted to go there themselves. Craftsmen from far and near could count upon finding not only customers for their own goods but also people selling other items that would be attractive, either in other markets or for their masters.

The immediate background to the foundation of the town was the expansion of the kingdom of the Danes that began with the two kings Sigfred and Godfred in the final decades of the 8th century and the first decade of the 9th. This was carried on by their successors down to the middle of the 9th century, when the kingdom seems to have fallen apart (Skre 2007j:458–69; 2008c:338–41; 2008d:347–55). The kingdom was under pressure from Frankish expansion northwards, and the foundation of the three towns of Ribe, Kaupang and Hedeby was probably part of a political strategy to consolidate the kingdom.

A passage in the Frankish Annals shows that in 813 there was a conflict between the king of the Danes and the "principes et populus" of Vestfold (Skre 2007j:460–1, and below, p. 445). With reference to the poem *Ynglingatal*, it appears that the Ynglings may have left Skiringssal at this juncture and settled further north in the territory, at Borre, to return to Kaupang and Skiringssal towards the end of the 9th century (Skre 2007j:466–8). One should, however, pay greater attention than in the publication of 2007 (Skre 2007j) to the fact that *Ynglingatal* was composed around the year 900: in other words at a time when Vestfold and Skiringssal were part of the Norwegian kingdom. The lands of the Ynglings are in fact explicitly described as *Norwegian* in stanza 35 of the poem (Skre 2007j:467). There may, at that time, have been a need to distance oneself politically from the period in which Kaupang was the Danes' town, and the poet's patron may have been more concerned about following a genealogical line back to those who were resident at Borre during the first half of the 9th century. There may well, then, have been petty kings who regarded themselves as Ynglings throughout the history of Kaupang, but if so they would have been in the service of the king of the Danes, and it would not have been appropriate to include them when the poem was composed.

The economic context

During the 8th century, large areas of Scandinavia moved away from an economy that was essentially local and primarily based upon the exploitation and consumption of local resources, to one characterized to a greater extent by trade with and robbery from, far-off lands. There had been long-distance trade before, but it was essentially the uppermost layer of society who participated in that. What happened in the 8th century was that a much broader section of society gained access to goods from plunder and trade. There was economic and military expansion outside of Scandinavia but trans-regional trade increased also within Scandinavia. In crafts' output in Scandinavia, regional types were superseded by super-regional types. At the same time, agricultural output came to be directed more towards the production of surpluses, while the specialist production of iron and hides etc. took off (Skre 2008d:353).

The foundation of Kaupang happened at the same time as Scandinavians became militarily and economically involved in the British Isles. The expansion to the West was the last of three waves of movement out of Scandinavia that had begun at the very beginning of the 8th century. At that time, people from the southern and eastern parts of Scandinavia became involved in an economic and territorial expansion around the Baltic, where a number of seasonal trading sites developed during the 8th century. From the same period, people from the south-western parts of Scandinavia were engaged in a growing trade with Frisian lands, with Ribe and Dorestad as the most important sites.

Kaupang was the only one of the three south-western Scandinavian towns founded around AD

800 which had connexions with all three of these trade routes: the southern, the eastern and the western. Ribe was essentially looking towards the Frankish/Frisian trade, and Hedeby also towards the Baltic. Kaupang, moreover, was the only town that facilitated transport of goods from western Scandinavia into southern Scandinavia, the Baltic, and the Frankish and Frisian lands.

Kaupang was also the first and, as far as is known, the only specialized site for trade and craft founded in western Scandinavia prior to the late 10th and the 11th centuries (Skre 2008j). The town can be regarded, therefore, as the most north-westerly example of a type of site that had been established in great numbers in southern and eastern Scandinavia over the preceding centuries (Skre 2008j:337–8). The absence of such sites further north and west is probably due to the fact that the production and exchange of goods in that zone took place in some different context, presumably more closely tied to households and social networks than to major gatherings of people at central places, at market sites, and in towns.

17.2 To Ireland and the North, c. AD 800–850/70

In 813, somewhere north of the Elbe, sixteen emissaries of the Frankish Emperor met by agreement with an equal number of representatives of the two brothers who were the kings of the Danes. The intention was to establish peace, as well as to have a further brother of the kings released from the Emperor's keeping. Both parties appear to have behaved as agreed, and the emissaries exchanged other information, for instance about where the two kings were at that time. This information was evidently so interesting that it was included in the Frankish party's report upon its return and written down in the Frankish Annals, where it states (Rau 1995:102; trans. John Hines, Jan Schumacher):

Qui tamen eo tempore domi non erant, sed at Westarfoldam cum exercitu profecti, qua regio ultima regni eorum inter septentrionem et occidentem sita, contra aquilonem Britanniae respicit, cuius principles ac populus eis subici recusabant.

They [sc. *the kings*], however, were not at home at that time, having set out for Vestfold with an army. That region is at the edge of their kingdom, located between North and West, and, facing into the North Wind, looks towards the top of Britain. The leaders and people of that region were refusing to be their subjects.

As this is the only contemporary written source that reveals into which geographical context the men closest to the kings of the Danes placed Vestfold, it is worth discussing it in some detail.

This account of the position of Vestfold has created problems for many scholars (e.g. Scholz 1972:96, who located "Westarfold" within the British Isles). The confusion is created by the fact that if a person in Vestfold 'faces the North Wind' (the wind that blows from the North), that person certainly does not look towards the northern tip of Britain, which in fact lies directly westwards (Skre, this vol. Ch. 16:Fig. 16.1).

The same sort of problematic directions appear in many Scandinavian and Icelandic sources of the Viking Period and the following centuries, and there has been a lengthy debate over how they should be read. Amongst others, Richard Ekblom (1942) supported a theory that there was a peculiarly Scandinavian system of orientation in which the compass was turned 45° or 60° clockwise. As Korhammer, for instance, has shown (1985), this theory has little foundation in the sources. He also points to the fact that Ekblom's theory assumes that the Scandinavians then oriented themselves in terms of the particular form of geographical abstraction that is not found until much later cartographic projections.

Studies of traditional terminology for giving directions, for instance in Iceland (e.g. Einarsson 1944; Haugen 1957), reveal that a much more practical approach is needed to understand the geographical terminology of the sources. Directions were not given to help people find the place on a map but rather as constituents of navigational accounts, and so contained what information was necessary for a traveller to reach the intended goal. Since navigation was undertaken using landmarks, there were only two possible directions to go along a coast, and only a quite simple guide needed to be given to identify which was to be taken (Korhammer 1985:258–62). It was sufficient, in fact, to state whether the land was to be on the starboard or to port, and such directions are common, as on several occasions in Ohthere's account.

Some frequently used sailing routes were given specific names. Such names often indicated the quarter of the sky under which the land lies that the traveller will end up in after sailing that route. This is not to state which quarter of the sky the voyage itself was directed towards at various points along the route, but rather of the direction in which the land in question lay – north, south, east or west. Sailing from the south along the west coast of Scandinavia brings the traveller to the land in the North, and this is why the general direction of that coastline is traditionally regarded as North–South (Englert 2007:126). Accordingly, that sailing route was known from the 9th century as *Norðweg*, "the route to the North", from which the land takes its name of Norway (Stemshaug et al. 1976:236). In places, this route is in quite different directions from northwards, but sailing it will bring you to the land in the North: seen from the South, whence the name must derive. Therefore, the passage "facing into the North Wind" should be read 'sailing the *Norðweg*'.

What the passage from the year 813 reveals, then, is that from a starting-point in Denmark, Vestfold lay to the North-West, along the route they would follow to get to the northern point of Britain; and when going there they would sail from Vestfold along the sea-route called *Norðweg*, probably as far as Rogaland, from where they would cross the North Sea.

The fact that the Danish emissaries mentioned Britain as a reference point for the location of Vestfold in 813 was certainly in part due to the fact that their Frankish counterparts knew where that island lay, and so would have a known point of reference for the position of Vestfold. However the sea-route to Rogaland, and then on to Britain, via Vestfold and the south coast of Norway must have been well known to the Danes. The first recorded visits from sea-going Scandinavians in the British Isles took place only a couple of decades earlier, in the years around 790. In the first third of the 9th century, Scandinavian activity in Western Europe was directed primarily to Ireland, and to some extent Scotland and Northern England as well (Graham-Campbell 1998; Morris 1998; Ó Córrain 1998; Ó Floinn 1998).

People from all along the south coast of Norway as far north as Trøndelag took part in the Scandinavian expansion to Scotland and Ireland. This is shown, amongst other things, by the distribution of 9th-century Insular metal ornaments in Norway, which cluster in five areas: Vestfold (7), Rogaland (12), Sogn (6), Møre (5) and Trøndelag (8) (Wamers 1985:Karte 4–8). The earliest finds of all are concentrated in Sogn and Møre in Western Norway (Wamers 1985:Karte 3), and this may consequently suggest that the activity originated there.

When, around the year 800, the king of the Danes founded his town in Vestfold, one of his objectives may have been to establish a fixed point along the new and promising sea-route to Northern England, Scotland and Ireland. In this way he could help to make his people's navigation in that direction safer and gain a share of the streams of goods that the rich opportunities for trade and plunder made available. Alongside an economic motive of this kind, a more secure base in Vestfold may have been intended to protect the central regions of the kingdom against raids by armed bands from the western coast of Norway by forming links with the petty kings of the region and gathering information on possible attacks.

Amongst the traded goods in the archaeological finds from Kaupang one can see the connexion with the northern and western parts of the British Isles from the very beginning. Jet is found as early as SP I and in all the later Site Periods (Resi, this vol., Ch. 6:125). Lead, which must be from the Irish Sea, has the same chronological distribution (Pedersen, in prep.; Skre, this vol., Ch. 16:423, 428). The unusually extensive use of lead for a Scandinavian site by the metalcasters at Kaupang (Pedersen, in prep.) may be linked to the fact that Kaupang was in closer contact than the other Scandinavian towns with the lands around the Irish Sea where lead was readily available. Three Insular artefacts have been found in graves that can be dated to the first half of the 9th century (a pin-case in Ka. 210; a gilt copper-alloy mount in Ka. 268; and a book-mount in Ka. 304). The character and the re-working of these artefacts (Wamers, this vol., Ch. 4:93), indicates that it was Scandinavians who had brought them from Britain or Ireland to Kaupang, not natives of the British Isles (Skre, this vol., Ch. 16:440).

Even if people from Ireland or Britain formed no significant part of the settled or transient population of Kaupang, other non-Scandinavians did so, however. These were people from the western Slavic and Frisian lands (Skre, this vol., Ch. 16:431–5). There is evidence of craftsmen and traders. Down to c. 820 they were resident on a seasonal basis, first under the open sky or in temporary shelters such as tents or overturned boats, and later in buildings for intermittent occupation. It was only from the 820s, it seems, that people began to dwell permanently on the site (Skre, this vol., Ch. 15:413–15).

The manufacture of glass beads in SP I and early in SP II is clearly similar in certain respects to what was going on in Ribe and Åhus at the same time (Wiker, in prep.; Skre, this vol., Ch. 15:404), and the beadmakers probably came to Kaupang from southern Scandinavia. They presumably came only on a seasonal basis because beadmaking disappeared from Kaupang before permanent occupation started, only to re-appear on a more limited scale after c. 850. This cessation is probably linked to the fact that oriental beads of high quality were arriving in Kaupang in large quantities via the Frisian lands and the Baltic (Wiker, in prep.; Skre, this vol., Ch. 16:425–6), and the local beadmakers effectively could not compete.

The metalcasters were from the South too. The clear southern and south-eastern Scandinavian bias in the range of types produced by the metalcasters at Kaupang in SP II shows that they were probably from Danish territories. One particular type, round pendants with cruciform motifs, of which there are five examples from Kaupang and which appeared in SP II, shows clear influence from Frankish or Frisian areas (Pedersen, in prep.; Wamers, this vol., Ch. 4:92). Jewellery like this is otherwise only found in Scandinavia at Ribe, Hedeby and Birka, and it appears to have been manufactured at some of these sites (Pedersen, in prep.). These are towns in which Franks or Frisians were living, or may have done so, and it is not impossible that the pendants were made by Frisian metalcasters. They could, however, also have been included amongst the range of products of Scandinavian metalcasters, although perhaps meant primarily for Frankish or Frisian customers.

The scope for identifying traders is much less favourable than that for tracing some of the craftsmen, especially in the occupation deposits from the period in which activity was only seasonal. These deposits were probably left behind primarily by those who had come to Kaupang to produce goods to sell there. Those who came to buy and sell will have left few traces apart from the odd lost item and possible remains of domestic activities. It is only with the inception of permanent settlement from c. 820 that it is possible to identify traders in the archaeological evidence; they may, however, have been present earlier.

The Frankish or Frisian pottery of SP I and the whole of SP II may have been left by craftsmen from those areas, but could also have been left by traders, such as can be identified amongst the permanent inhabitants of Kaupang in SP II (Skre, this vol., Ch. 16:431–2). It is not possible to tell whether Slavs were involved in such trade, but Scandinavians must certainly have been so, as not only traded goods but settlers appear to have come to Kaupang from southern Scandinavia. On the evidence of the ceramic evidence, it appears probable that Plot 1A was occupied by Danes in the second quarter of the 9th century.

There must have been visitors and settlers from western Scandinavia in Kaupang at this period, because the range of items in graves of the first half of the 9th century includes western Scandinavian types of dress-accessory, while on several of the plots in SP I a method of cooking using hot stones was used that was the predominant practice in western Scandinavia at the beginning of the Viking Period. Besides possible signs that one building was used as a smithy (Skre, this vol., Ch. 16:438), the evidence does not provide a basis for determining whether these people were there to trade or as producers. Nevertheless it may be possible to say a little more about them. The trade goods they brought with them to Kaupang, in order to pay for goods that were brought to the town from southern Scandinavia, the Baltic and the Frankish Empire, provide some indications of which parts of western Scandinavia they were from. In the first half of the 9th century this concerns the iron and dark-schist whetstones. The iron was probably brought to Kaupang from the Opplands, the interior of eastern Norway, and the whetstones probably from the same areas (Skre, this vol., Ch. 16:430).

Goods definitely from the West and North of Norway cannot be identified at Kaupang, but it is in no way impossible that some goods came from there. All the same, the predominant impression of the comparison of Insular and Continental imports in Scandinavia is that western and northern Norway were primarily oriented westwards, Denmark to the South, and Sweden to the East. The amount of Frankish imports in Norwegian graves of the 9th and 10th centuries is very low compared with Insular counterparts; only Kaupang forms an exception, with a predominance of Frankish items (Wamers, this vol., Ch. 4). Kaupang is thus more like the picture that is familiar in Denmark, with strong connexions to the Frankish/Frisian areas, albeit supplemented to a greater degree than in Denmark with Insular material – probably due to the fact that this was the port of entry in the Danish kingdom for the sea-route from Britain and Ireland.

The picture that the distribution of Frankish and Insular imports paints must, however, be counterbalanced by that of the distribution of southern Scandinavian dress-accessories along the coast of western Scandinavia. From as early as the 8th century right through the Viking Period there is a high presence of types of jewellery that were manufactured, amongst other places, in Ribe, Kaupang and Hedeby (Eldorhaugen 2001:figs. 3–5). Some of these may have been made by travelling craftsmen, but the amount is so great that it appears more likely that direct contacts, like Ohthere's, with the towns of southern Scandinavia were maintained. The lack of imported Frankish items along the coast of western Scandinavia west of Kaupang could be because Britain and Ireland were their main fields for plunder, not Francia.

17.3 Kaupang between East and West, c. AD 850/70–930

At the end of the 9th century, then, whoever commissioned *Ynglingatal* and its author considered Vestfold to be part of the kingdom of Norway. Although Viken remained a contested area between the kings of Norway and Denmark for the next three centuries, this was not a struggle with national overtones. It was conducted at the highest political level, that at which *Ynglingatal* was composed and recited; trade passed the political frontiers relatively unhindered. It was kings and petty kings who were fighting each other, not the craftsmen or traders.

In the first half of the 9th century the town probably served as a port of entry to the Danish kingdom for all of the sea-borne traffic from the Irish Sea and the long coastline of western Scandinavia, and thus as a place at which tolls could be demanded and, perhaps, where the king's right to the pre-emption of goods was exercised. Since the late 9th century the town gradually became part of the Norwegian kingdom, and the Norwegian king may have demanded similar income from and rights over his people in Skiringssal. That may have affected the changes that appeared amongst the population of Kaupang and their activities.

In the second half of the 9th century visitors and settlers from the western Slav and Frisian regions stopped coming to Kaupang. The point at which new Frisian settlers and traders stopped coming can be dated sometime between 850 and 870, and it was probably connected to the abandonment of Dorestad around 860 and the general decline of trade in the southern North Sea region. The point at which visitors from Slavic areas stopped coming cannot be dated more closely than to sometime between 850 and 890. Trade with Slavic regions may, notwithstanding, have continued, as a part of the Baltic trade (Skre, this vol. Ch. 16:Fig. 16.1).

The clearest non-Scandinavian contact that was still maintained was trade with the lands around the Irish Sea, and the importation of personal equipment from there by Scandinavians. This is highly congruent with the new political context of Kaupang: the Norwegian kingdom looked to a very large extent towards the western seas. Lead continued to arrive in Kaupang from the Irish Sea, and a new group of finds appears: broad-band silver armrings, of which there are seven at Kaupang (Skre, this vol., Ch. 16:428, Fig. 16.1). These can be dated to the period 850–940, and the large number testifies to frequent trade with Ireland over longer or shorter stretches during this period. The Scandinavians who were responsible for this trade also brought Irish goods as personal possessions with them. In four graves from the period 850–950 (Ka. 219, Ka. 283, Ka. 296 and Ka. 300) and in two from the period 900–950 (Ka. 279 and Ka. 298) imported Insular artefacts have been found.

Kaupang's new connexion with the Norwegian kingdom that had the West (Rogaland, Hordaland and Sogn) as the seat of its power may be the reason why, from the middle of the 9th century, the presence of personal equipment from western Scandinavia is more prominent at Kaupang. A much higher proportion of the new inhabitants who settled in the town at this period seem therefore to have come from there. Meanwhile there is little or no evidence of immigration from southern Scandinavia. This, however, must be linked to the fact that it is only pottery that would enable us to identify such settlers, and there is none of that in datable contexts later than SP II. Consequently there is no basis for any discussion of whether new southern Scandinavian settlers came to Kaupang after c. 850 even though the continued use of the cemetery at Bikjholberget may indicate that.

There is, however, nothing to suggest that the trade links with southern Scandinavia diminished. In the first half of the 9th century, trade with southern and eastern Scandinavia – the latter must have been through Danish waters – can be demonstrated through the presence of hacksilver, together with oriental beads which came through the same areas. This trade continued in the second half of the 9th century, from which period the evidence is more plentiful. In this case, the evidence comprises items linked to making payment: dirhams, hacksilver and weights (Blackburn 2008; Hårdh 2008; Pedersen 2008; Skre, this vol., Ch. 16:437). Until the demise of the town around 930 Kaupang was the north-westernmost limit of the tight and cohesive distribution area of dirhams and weights (cubo-octahedral and oblate spheroid), which runs from the Baltic shores north to Uppland and the south coast of Finland, and west to Denmark. The number of finds of both types in Kaupang is high, while their presence elsewhere in western Scandinavia is sporadic in the extreme (Steuer et al. 2002:Abb. 4; Kilger 2008c).

In the period following c. 850, Kaupang appears, then, to have been situated in a border zone: not just a political border zone between the Norwegian and Danish kingdoms but also an economic border zone between the economies of western Scandinavia and southern and eastern Scandinavia. The western economy, which made use of silver as a form of currency to a minor extent if at all, produced iron and other goods for export, and was provided with resources through plunder and trade in Britain and Ireland. The eastern economy, which made extensive use of silver as currency, was founded upon trade with the western Slav areas, with the Caliphate via the Russian rivers, and to some extent with the Frankish Empire via Hedeby.

The urbanization that Scandinavians were responsible for in Ireland by the middle of the 9th century (Sheehan 2008) was most probably the result of people from areas that already had towns – in other words, Danes, including folk from Viken – settling there. For people from elsewhere in western Scandinavia urbanization was hardly an appropriate way of organizing a settlement. After the abandonment of Kaupang around 930, it was only at Trondheim at the end of the 10th century, Oslo c. 1000, and at Bergen and Tønsberg at the end of the 11th century, that urban communities were established in western Scandinavia. But towns continued to be much fewer and further between than elsewhere in Scandinavia. Urbanization did not reach the Norse settlements in the western Norwegian maritime empire, in Iceland, Shetland and the Faeroes, until modern times.

The slight and late High-medieval urbanization of western Scandinavia thus had its roots back in the 9th and 10th centuries. It is possible that the difference is even older, as the characteristic central places of eastern and southern Scandinavia with their extensive evidence of trade and craft have not as yet been matched in western Scandinavia except in Viken. It is possible that these differences are to be viewed in connexion with the much more extensive High- and Late-medieval use of commodity money in western Scandinavia than in the South and East (Skre 2008c:330–3). A closer study of these interesting, definitive and persistent differences between parts of Scandinavia goes beyond the limits of the present series of reports and discussions, but a good place to start would probably be the differences in currencies and in economic mentality in High-medieval Scandinavia (Þorláksson 1992; Lunden 1999; Norseng 2000; Pettersen 2000; Gullbekk 2005; Hybel and Poulsen 2007; Skre, in press).

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Abbreviations

Ab	*Aarsberetning. Foreningen til norske fortidsminnesmerkers bevaring.* Kristiania.
B	Finds kept at Bergen Museum, University of Bergen
Bj	Finds from Birka kept at SHM
AUD	*Arkeologiske udgravninger i Danmark*. Rigsantikvarens Arkæologiske Sekretariat. København
BMR	Bornholms Museum, Rønne
C	Finds kept at Museum of Cultural History (KHM), University of Oslo
CRM	Cultural resource management excavations (c.f. Pilø and Skre, this vol. Ch. 2:21–2)
fnr.	Inventory number, Blindheim's excavations 1950–1984
Inv. no.	Inventory number
Ka.	Kaupang grave number according to Stylegar 2007:Catalogue
KHM	Museum of Cultural History, University of Oslo
KLNM	*Kulturhistorisk leksikon for nordisk middelalder*, vol. 1–22. Oslo, 1956–1978.
KVHAA	Kungliga vitterhets historie och antikvitets akademien, Stockholm.
LUHM	Lund University Historical Museum
MRE	Main research excavation (c.f. Pilø and Skre, this vol. Ch. 2:21)
NM	Finds kept at The National Museum of Denmark, København
P	Figure reference in Petersen 1928
R	Rygh 1885
RAÄ	Riksantikvarieämbetet, Stockholm
RGA	*Reallexikon der Germanischen Altertumskunde*, vol. 1–35. de Gruyter. Berlin 1973–2008.
ROB	Rijksdienst voor het Oudheidkundig Bodemonderzoek
S	Finds kept at Museum of Archaeology, University of Stavanger
SF	Sherd Family (Gaut, this vol. Ch. 9)
SHM	Statens Historiska Museum, Stockholm
SP	Site Period (c.f. Pilø and Skre, this vol. Ch. 2:23–6)
St	Finds kept at Archaeological Museum, University of Stavanger (AM)
T	Finds kept at Vitenskapsmuseet, The Norwegian University of Science and Technology, Trondheim
Ts	Finds kept at Tromsø University Museum
UKM	Museum of Cultural History, University of Oslo (now KHM)
Å	Finds kept at Ålesund Museum

References

Aagård, G.-B. 1984: Gleicharmige Spangen. In: G. Arwidsson (ed.): *Systematiche Analysen der Gräberfunde*. Birka, vol. 2:1, pp. 95–110. Almqvist & Wiksell. Stockholm.

Aasheim, R.M. 2007: Glassbegrene i jernalderen – symbol og funksjon. Unpublished Master thesis, IAKH, Universitet i Oslo.

Aitken, E., G. Arwidsson 1986: Armringe, Armbügel und Fingerringe. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde.* Birka, vol. 2:2, pp. 73–6. Almqvist & Wiksell. Stockholm.

Alcock, L. 1963: *Dinas Powys, an Iron Age, Dark Age and early Medieval Settlement in Glamorgan*. University of Wales Press. Cardiff.

Alfsen, E.B., O.H.J. Christie 1979: Massenspektrometische Analysen von Specksteinfunden aus Haithabu und wikingerzeitlichen Specksteinbrüchen in Skandinavien. In: H.G. Resi (ed.): *Die specksteinfunde aus Haithabu*. Berichte über die Ausgrabungen in Haithabu, vol. 14, pp. 170–84. Wachholtz. Neumünster.

Allason-Jones, L, J.M. Jones 2002: Identification of 'Jet' Artefacts by Reflected Light Microscopy. *European Journal of Archaeology*, vol. 4, pp. 233–51.

Ambrosiani, B. 1985: Specialization and urbanization in the Malaren Valley – a question of maturity. In: S.-O. Lindquist (ed.): *Society and trade in the Baltic during the Viking-period.* Acta Visbyensia, vol. 7, pp. 103–12. Visby.

– 1995: Beads of Glass and Semi-precious Stone. In: B. Ambrosiani, H. Clarke (eds.): *Excavations in the Black Earth 1990*. Birka Studies, vol. 2, pp. 52–63. RAÄ. Stockholm.

– 1999a: Bronsgjutare på Helgö och i Birka. In: K. Andersson, A. Lagerlöf, A. Åkerlund (eds.): *Forskaren i fält – en vännbok till Kristina Lamm*, pp. 117–21. Stockholm.

– 1999b: Birka and Dorestad. In: H. Sarfatij, W.J.H. Verwers, P.J. Woltering (eds.): *In discussion with the past: archaeological studies presented to W.A. van Es,* pp. 239–42. Foundation for Promoting Archaeology. Amersfoort.

– 2002: Osten und Westen im Ostseehandel zur Wikingerzeit. In: K. Brandt, M. Müller-Wille, C. Radtke (eds.): *Haithabu und die frühe Stadtentwicklung im nördlichen Europa*, pp. 339–48. Wachholtz. Neumünster.

Ambrosiani, B., B. Arrhenius, K. Danielsson, O. Kyhlberg, G. Werner 1979: *Birka. Svarta jorden hamnområde. Arkeologisk undersökning 1970–1971.* Riksantivarieämbetet rapport C1. Stockholm.

Ambrosiani, B., B.G. Erikson 1992: *Birka. Vikingastaden*, vol. 2. Wiken. Stockholm.

Ament, H. 1976: *Die fränkischen Grabfunde aus Mayen und der Pellenz*. Germanische Denkmäler der Völkerwanderungszeit, Serie B., vol. 9. Mann. Berlin.

Andersen, H. 1981: Die Kleinfunde. In: G.P. Fehring, M. Gläser (eds.): *Lübecker Schriften zur Archäologie und Kulturgeschichte*, vol. 5, pp. 81–94. Habelt. Bonn.

Andersson, E. 2000: Textilproduktion i Löddeköpinge – endast för husbehov? In: F. Svanberg, B. Söderberg (eds.): *Porten til Skåne. Löddeköpinge under järnålder och medeltid*. Riksantikvareämbetet Skrifter, vol. 3, pp. 158–87. Malmö.

– 2003: *Tools for Textile Production from Birka and Hedeby.* Birka Studies, vol. 8. RAÄ. Stockholm.

Anderton, M. (ed.) 1999: *Anglo-Saxon Trading Centres. Beyond the Emporia*. Cruithne Press. Glasgow.

Andrén, A. 1986: I städernas undre värld. In: A. Andrén (ed.): *Medeltiden och arkeologin. Festskrift til Erik Cinthio*. Lund studies in medieval archaeology, vol. 1, pp. 259–69. Lunds uni-

versitets historiska museum. Lund.
Andrews, P. 1997: *Excavations at Six Dials*. Excavations at Hamwic, vol. 2. CBA Research Report, vol. 109. York.
'Annals of Fulda'=*Annals of Fulda. Translated and annotated by T. Reuter*. Ninth century histories, vol. 2. Manchester University Press. Manchester, 1992.
Arbman, H. 1937: *Schweden und das Karolingische Reich. Studien zu den Handelsverbindungen des 9. Jahrhunderts*. KVHAA. Stockholm.
– 1940–3: *Die Gräber. Text und Tafeln*. Birka, vol. 1. Almqvist & Wiksell. Stockholm.
Arents, U. 1992: Die wikingerzeitlichen Grabfunde von Haithabu (Kreis Schleswig-Flensburg). Unpublished Doctoral thesis, University of Kiel.
Armbruster, B.R. 2002: Die Preßmodel von Haithabu. In: K. Brandt, M. Müller-Wille, C. Radtke (eds.): *Haithabu und die frühe Stadtentwicklung im nördlichen Europa*. Schriften des Archäologischen Landesmuseums, vol. 8, pp. 219–80. Wachholtz. Neumünster.
Arrhenius, B. 1971: *Granatschmuck und Gemmen aus nordischen Funden des frühen Mittelalters.* Acta Universitatis Stockholmensis. Studies in North-European Archaeology. Series B. Stockholm.
– 1973: Gjutformar och deglar, påträffade i Birka. *Birka. Svarta jordens hamnområde*. Riksantikvarieämbetets Rapport C1, pp. 99–114. Stockholm.
– 1976: Bergkristall. *RGA*, vol. 2, pp. 267–9.
– 1978: Ein Amethystanhänger aus Haithabu. *Das Achäologische Fundmaterial,* vol. 3. Berichte über die Ausgrabungen in Haithabu, vol. 12, pp. 9–23. Wachholtz. Neumünster.
– 1985: *Merovingian garnet jewellery: Emergence and social implications.* Almqvist & Wiksell. Stockholm.
– 1997: Granater som regalier. Arkeologiska källor til aristokratiska miljöer i Skandinavien under yngre järnålder. In: J. Callmer, E. Rosengren (eds.): *"gick Grendel att söka det höga huset..."*. Slöinge projektet, vol. 1, pp. 39–46. Hallands länsmuseer, Halmstad.
Arwidsson, G. 1942: *Valsgärde 6*. Die Gräberfunde von Valsgärde, vol. 1. Almqvist & Wiksell. Uppsala.
– 1984: Glas. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde*. Birka, vol. 2:1, pp. 203–12. Almqvist & Wiksell. Stockholm.
– 1989a: Bernstein. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde.* Birka, vol. 2:3, pp. 53–5. Almqvist & Wiksell. Stockholm.
– 1989b: Spinnwirtel. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde.* Birka, vol. 2:3, p. 97. Almqvist & Wiksell. Stockholm.
Askvik, H. 1990: Petrographische Untersuchungen an Schieferwetzsteinen aus Haithabu. In: H.G. Resi (ed.): *Die Wetz- und Schleifsteine aus Haithabu*. Berichte über die Ausgrabungen in Haithabu, vol. 28, pp. 135–42. Wachholtz. Neumünster.
– 2008: Whetstones from Kaupang; petrographic description and provenance. In: H. Askvik , H.G. Resi: *Whetstones and grindstones in the settlement area. The 1956–1974 excavations.* Kaupang-funnene, vol. 3:C. Norske oldfunn, vol. 29, pp. 5–17. KHM. Oslo.
Åstveit, L.I. 2006: Som man leter finner man. Røys, boplass og materiell kultur fra mellomneolitikum på Nordvestlandet. *Primitive tider*, vol. 9, pp. 71–84.
Attenborough, F.L. 1922: *The Laws of the Earliest English Kings. Edited and translated by F.L. Attenborough.* Cambridge University Press. Cambridge.
Aufleger, M. 1996: Metallarbeiten und Metallverarbeitung. *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 618–28. Philipp von Zabern. Mainz.
Augdahl, E. 1979: Inhaltsreste der Specksteingefäße aus Haithabu. In: H.G. Resi (ed.): *Die specksteinfunde aus Haithabu.* Berichte über die Ausgrabungen in Haithabu, vol. 14, pp. 168–9. Wachholtz. Neumünster.
Axboe, M. 1992: Metal og magt? Detektorfund fra jernalderbopladser. *Arkæologiske udgravninger i Danmark,* 1991, pp. 18–32. København.
Bach, H., S. Dušek 1971: *Slawen in Thüringen. Geschichte, Kultur und Anthropologie im 10. bis 12. Jahrhundert. Nach den Ausgrabungen bei Espenfeld*. Hermann Böhlaus Nachfolger. Weimar.
Bäck, M. 1995: Importkeramiken i Birka. *Meta,* 1995:1, pp. 4–21.
– 1997: No Island is a Society. Regional and Interregional interaction in Central Sweden during the Viking-period. In: H. Andersson, P. Carelli, L. Ersgard (eds.): *Visions of the past: trends and traditions in Swedish medieval archaeology.* Lund studies in medieval archaeology, vol. 19, pp. 129–61. RAÄ. Stockholm.
Bakka, E. 1963: *Some English Decorated Metal Objects Found in Norwegian Viking Graves.* Årbok Univ. Bergen, Human. Ser., vol 1:1963. Bergen.
– 1971: Scandinavian Trade Relations with the Continent and the British Isles in the Pre-Viking Times. *Early Medieval Studies*, vol. 3. Antikvariskt arkiv, vol. 40, pp. 37–51. Stockholm.
– 1993: Gauselfunnet og bakgrunnen for det. In: B. Solberg (ed.): *Minneskrift til Egil Bakka*. Arkeologiske Skrifter, vol. 7, pp. 269–79. Historisk Museum. Bergen.

Bakkevig, S. 2006: Mer om god mat i fortiden. *Frá haug ok heiðni*, 2006:1, pp. 19–25.
Barrett, J., A. Hall, C. Johnstone, H. Kenward, T. O'Connor, S. Ashby 2007: Interpreting the Plant and Animal Remains from Viking-age Kaupang. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 283–319. Aarhus University Press. Århus.
Bass, G.F. 1984: The Nature of the Serçe Limani Glass. *Journal of Glass Studies*, vol. 26, pp. 64–9.
Bass, G.F., S.D. Matthews, J.R. Steffy, F.H. van Doorninck jr. 2004: *Serçe Limani: An Eleventh-Century Shipwreck: The Ship and Its Anchorage, Crew, and Passengers.* Texas A&M University Press.
Bately, J. 2007: Text and translation: the three parts of the known world and the geography of Europe north of the Danube according to Orosius' Historia and its Old English version. In: J. Bately, A. Englert (eds.): *Ohthere's voyages. A late 9th-century account of voyages along the coasts of Norway and Denmark and its cultural context*, pp. 40–58. The Viking Ship Museum. Roskilde.
Batey, C.E. 1993: The Viking and Late Norse graves of Caithness and Sutherland. In: C.E. Batey, J. Jesch, C.D. Morris (eds.): *The Viking Age in Caithness, Orkney and the North Atlantic*, pp. 148–64. Edinburgh University Press. Edinburgh.
Baug, I. 2004: Innberetning fra undersøkelse av vikingtidens havnebasseng på Kaupang, gnr. 1029, bnr. 1, Larvik kommune, Vestfold. Unpublished report, KHM Archive.
Baumgartner, E., I. Krueger 1988: *Phönix aus Sand und Asche: Glas des Mittelalters*. Klinkhardt & Biermann. München.
Bautsch, H.J. 1995: Mineralogisch-petrographische Untersuchungen zur Herkunftsbestimmung frühmittelalterlicher Wetzsteine. *Veröffentlichungen des Brandenburgischen Landesmuseums für Ur- und Frühgeschichte*, vol. 29, pp. 237–44.
Baxter, M.J. 2003: *Statistics in Archaeology*. Hodder Arnold. London.
Bayley, J. 2000: Glassworking in Early-medieval England. In: J. Price (ed.): *Glass in Britain and Ireland AD 350–1100*. British Museum Occasional Papers, vol. 127, pp. 137–41. London.
– 2006: Early-medieval lead-rich glass in the British Isles. Conference poster at AIHV-17. International Society for the History of Glass, Antwerp, Belgium 4–8 September.
Beck, H. 1973: Axtkult. Philologisches. *RGA*, vol. 1, pp. 567–8.
Bencard, M. 1978: Wikingerzeitliches Handwerk in Ribe. *Acta Archaeologica*, vol. 49, pp. 113–38.
– 1990: The stratigraphy and dating of 8th-century Ribe. *Journal of Danish Archaeology*, vol. 7, pp. 225–8.
Bencard, M., L. Bender Jørgensen, H. Brinch Madsen (eds.) 1990: *Ribe Excavations 1970–76*, vol. 4. Sydjysk Universitetsforlag. Esbjerg.
Bender Jørgensen, L. 1986: *Forhistoriske tekstiler i Skandinavien*. Det Kongelige Nordiske Oldskriftselskab. København.
Bersu, G.U., D.M. Wilson 1966: *Three Viking Graves in the Isle of Man*. Society for Medieval Archaeology, Monograph series, vol. 1. London.
Biddle, M., B. Kjølbye-Biddle 2001: Repton and the 'great heathen army', 873–4. In: J. Graham-Campbell, R. Hall, J. Jesch, D.N. Parsons (eds.): *Vikings and the Danelaw*, pp. 45–96. Oxbow Books. Oxford.
Biek, L., J. Bayley 1979: Glass and other vitreous materials. *World Archaeology*, vol. 11. pp. 1–25.
Bierbrauer, V. 1996: Romanen im fränkischen Siedelgebiet. In: K. von Welck, A. Wieczorek, H. Ament (eds.): *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 110–20. Philipp von Zabern. Mainz.
Bitner-Wróblewska, A. 2001: *From Samland to Rogaland. East-West connections in the Baltic basin during the early Migration Period*. Panstwowe Muzeum Archeologiczne. Warszawa.
Blackburn, M. 2005a: Coinage and Contacts in the North Atlantic during the Seventh to Mid-Tenth Centuries. In: A. Mortensen, S.V. Arge (eds.): *Viking and Norse in the North Atlantic*, pp. 141–51. Føroya Froðskaparfelag. Tórshavn.
– 2005b: Coin finds from Kaupang: A Viking emporium on the North Sea. In: C. Alfaro, C. Marcos, P. Otero (eds.): *XIII Congreso Internacional de Numismática, Madrid 2003, Actas*, vol. 2, pp. 1143–7. Madrid
– 2008: The coin-finds. In: D. Skre (ed.): *Means of Exchange*. Kaupang Excavation Project Publication Series, vol. 2, pp. 29–74. Aarhus University Press. Århus.
Blackmore, L. 2001: Pottery: Trade and Tradition. In: D. Hill, R. Cowie (eds.): *Wics. The Early Mediaeval Trading Centres of Northern Europe*. Sheffield Archaeological Monographs 14, pp. 22–42. Sheffield Academic press. Sheffield.
Blindheim, C. 1960: En amulett av rav. *Universitetets Oldsaksamling Årbok,* 1958–1959, pp. 78–90.
– 1969: Kaupangundersøkelsen avsluttet. *Viking*, vol. 33, pp. 5–40.
– 1973: Kaupang by the Viks Fjord in Vestfold. Excavations and research. *Archaeological contributions to the early history of urban communities in Norway.* Universitetsforlaget. Oslo.
– 1974: Gjennom jerntider – Landnåm og ekspansjon (Ca. 500 f. Kr. – ca. 1000 e. Kr.). In: J.W. Krohn-Holm (ed.): *Kulturhistorien. Tjølling*

Bygdebok, vol. 1, pp. 67–143. Tjølling Kommune.
– 1976: A collection of Celtic (?) bronze objects found at Kaupang (Skiringssal), Vestfold, Norway. In: B. Almqvist, D. Greene (eds.): *Proceedings of the Seventh Viking Congress*. 9–27. Royal Irish Academy. Dublin.
– 1978a: Vikinger – pirater eller handelsmenn? Noen refleksjoner over importsaksmaterialet fra markedsplassen på Kaupang. *Norske Videnskaps-Akademi Årbok*, 1977, pp. 15–40.
– 1978b: Trade problem in the Viking Age. Some reflections on Insular Metalwork Found in Graves of the Viking Age. In: T. Andersen, K.I. Sandred (eds.): *The Vikings*, pp. 166–76. Almqvist & Wiksell. Stockholm.
– 1981: Slemmedal-skatten. En liten orientering om et stort funn. *Viking*, vol. 45, pp. 5–31.
Blindheim, C., B. Heyerdahl-Larsen 1995: *Gravplassene i Bikjholbergene/Lamøya undersøkelsene 1950–1957. Del A. Gravskikk*. Kaupang-funnene, vol. 2:A. Norske oldfunn, vol. 16. IAKN, Universitetets Oldsaksamling. Oslo.
Blindheim, C., B. Heyerdahl-Larsen, A.S. Ingstad 1999: *Gravplassene i Bikjholbergene/Lamøya. Undersøkelsene 1950–1957. Del B: Oldsaksformer. Kulturhistorisk tilbakeblikk. Del C: Tekstilene*. Kaupang-funnene, vol. 2:B, C. Norske oldfunn, vol. 19. UKM, Oldsaksamlingen. Oslo.
Blindheim, C., B. Heyerdahl-Larsen, R.L. Tollnes (eds.) 1981: *Kaupang-funnene*, vol. 1. Norske oldfunn, vol. 11. Universitetets Oldsaksamling. Oslo.
Blindheim, M. 1984: A house-shaped Irish-scots reliquary in Bologna, and its place among the other reliquaries. *Acta Archaeologica*, vol. 55, pp. 1–53.
Blinkhorn, P. 1999: Of cabbages and kings: production trade, and consumption in middle-Saxon England. In: M. Anderton (ed.): *Anglo-Saxon trading centres: Beyond the Emporia*, pp. 4–23. Cruithne Press. Glasgow.
Bøe, J. 1940: *Norse Antiquities in Ireland*. Viking Antiquities in Great Britain and Ireland, vol. 3. Aschehoug. Oslo.
Böhme, H.W 1996: Söldner und Siedler im spätantiken Nordgallien. In: K. von Welck, A. Wieczorek, H. Ament (eds.): *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 91–101. Philipp von Zabern. Mainz.
Böhner, K. 1958: *Die fränkischen Altertümer des Trierer Landes*. Germanische Denkmälder der Völkerwanderungszeit, Serie B, vol. 1. Mann. Berlin.
Bohnsack, D. 1976: Bernstein und Bernsteinhandel. *RGA*, vol. 2, pp. 288–95.
Boon, G.C. 1966: Roman window glass from Wales. *Journal of Glass Studies*, vol. 8, pp. 41–5.
Botfeldt, K., H. Brinch Madsen 1991: The Amber. In: M. Bencard, L. Bender Jørgensen, H. Brinch Madsen (eds.): *Ribe Excavations 1970–76*, vol. 3, pp. 101–14. Sydjysk Universitetsforlag. Esbjerg.
Both, F. 1999: Keramik- und Glasimporte aus dem fränkischen Reich. In: F. Both, H. Aouni (eds.): *Über allen Fronten. Nordwestdeutchland zwischen Augustus und Karl dem Großen*, pp. 191–207. Verlag Inselsee. Oldenburg.
Botto, M. (ed.) 2000: *Sardegna*. Le Guide di Archeo, vol. 2. De Agostini Rizzoli Periodici. Roma.
Bourke, C. 1993: *Patrick. The Archaeology of a Saint*. Ulster Museum. Belfast.
Braat, W.C. 1964: Einige Baggerfunde aus holländischen Flüssen. *Bulletin van de Vereening tot Bevordering der Kennis van de Antieke Beschaving te's-Gravenhage*, vol. 39, pp. 185–91.
Brather, S. 1996: *Feldberger Keramik und frühe Slawen. Studien zur nordwestslawischen Keramik der Karolingerzeit*. Universitätsforschungen zur prähistorischen Archäologie, vol. 34. Habelt. Bonn.
– 2004a: *Ethnische Interpretationen in der frühgeschichtlichen Archäologie. Geschichte, Grundlagen und Alternativen*. Ergänzungsbände zum RGA, vol. 42.
– 2004b: The beginnings of Slavic settlement east of the river Elbe. *Antiquity*, vol. 78, pp. 314–29.
Braunfels, W. 1968: *Die Welt der Karolinger und ihre Kunst*. München.
Brøgger, A.W. 1909: *Den arktiske stenalder i Norge*. Videnskabs-Selskabets Skrifter II. Hist.-Filos. Klasse, 1909:1. Christiania.
Brooks, N., J. Graham-Campbell 2000: *Reflections on the Viking-age Silver Hoard from Croydon, Surrey*. In: N. Brooks (ed.): *Communities and Warfare 700–1400*, pp. 69–91. Hambledon Press. London.
Brorsson, T. 2005: *The Pottery from the early Medieval Trading Site and Cemetery at Gross Strömkendorf, Wismar, Mecklenburg*. Available online at http://www.geol.lu.se/kfl/
Brosh, N. 1990: Glass window-fragments from Khirbet Al-Mafjar. *Annales du 11e congrès de l'Association Internationale pour l'Histoire du Verre*, pp. 247–56. Amsterdam.
Brown, D.H. 1997: The Social Significance of Imported Medieval Pottery. In: C.G. Cumberpatch, P.W. Blinkhorn (eds.): *Not so much a pot, more a way of life. Current approaches to artefact analysis in archaeology*. Oxbow Monograph, vol. 83, pp. 95–112. Oxbow Books. Oxford.
Bruand, O. 2002: *Voyageurs et marchandises aux temps carolingiens. Les réseaux de communication entre Loire et Meuse aux VIIIe et IXe siècles*. Bibliothèque du moyen âge. vol. 20. DeBoeck Université. Bruxelles.
Brumfiel, E.M., T.K. Earle 1987: Introduction. In: E.M. Brumfiel, T.K. Earle (eds.): *Specialization,*

Exchange, and complex Societies, pp. 1–9. Cambridge University Press. Cambridge.
Bryhni, I. 2007: Rapport om petrografisk bestemmelse av tre mulige prøvesteiner fra Kaupang, Vestfold. Unpublished report, KHM Archive.
Buchwald, V.F. 2005: *Iron and steel in ancient times*. Det Kongelige Danske Videnskabernes Selskab. København.
Butt, J.J. 2002: *Daily life in the age of Charlemagne*. Greenwood Publishing Group. Westport, Connecticut.
Callmer, J. 1977: *Trade beads and bead trade in Scandinavia ca. 800–1000*. Acta archaeologica Lundensia, Series in 4°, vol 11. Gleerup. Lund.
– 1984a: Aspects on production and style: an essay with reference to the Merovingian and Early Viking Period material of Scandinavia.In: M. Høgestøl, J.H. Larsen, E. Straume, B. Weber (eds.): *Festskrift til Thorleif Sjøvold på 70-årsdagen*. Universitetets Oldsaksamlings Skrifter, no. 5, pp. 57–86.
– 1984b: Recent work at Åhus: Problems and Observations. *Offa*, vol. 41, pp. 61–75.
– 1989: Gegossene Schmuckanhänger mit nordischer Ornamentik. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde*. Birka, vol. 2:3, pp. 19–42. Almqvist & Wiksell. Stockholm.
– 1990: Vendeltida glasmästare på handelsplassen i Åhus. *Populär Arkeologi*, no. 8, pp. 20–2.
– 1991a: Beads as a criterion of shifting trade and exchange connections. *Studien zur Sachsenforshung*, vol. 7, pp. 25–38.
– 1991b: Platser med anknytning til handel och hantverk i yngre järnålder. Exempel från södra Sverige. In: P. Mortensen, B.M. Rasmussen (eds.): *Høvdingesamfund og kongemagt*. Fra stamme til stat i Danmark, vol. 2. Jysk Arkæologisk Selskabs Skrifter, vol. 22:2, pp. 29–47. Højbjerg.
– 1994: Urbanization in Scandinavia and the Baltic Region c. AD 700–1000: Trading Places, Centres and Early Urban Sites. In: B. Ambrosiani, H. Clarke (eds.): *Developments around the Baltic and the North Sea in the Viking Age*. Birka Studies, vol. 3, pp. 50–90. RAÄ. Stockholm.
– 1995a: The influx of Oriental beads into Europe during the 8th century A.D. In: M. Rasmussen, U.L. Hansen, U. Näsman (eds.): *Glass Beads. Cultural History, Technology and Analogy*. Studies in Technology and Culture, vol. 2, pp. 49–54. Historical-Archaeological Experimental Centre. Lejre.
– 1995b: Hantverksproduktion, samhällsförändringar och bebyggelse. Iakttagelser från östra Sydskandinavien ca. 600–1100 e.Kr. In: H.G. Resi (ed.): *Produksjon og samfunn. Om erhverv, spesialisering og bosetning i Norden i 1. årtusen e.Kr.* Universitetets Oldsaksamling Varia, vol. 30, pp. 39–72. Oslo.
– 1999: Vikingatidens likarmade spännen. In: B. Hårdh (ed.): *Fynden i centrum. Keramik, glas och metall från Uppåkra*. Uppåkrastudier, vol. 2. Acta archaeologica Lundensia. Series in 8°, vol. 30, pp. 201–20. Almqvist & Wiksell. Stockholm.
– 2002: North-European trading centres and the Early-medieval craftsman. Craftsmen at Åhus, north-eastern Scania, Sweden ca.AD 750–850+. In: B. Hård, L. Larsson (eds.): *Central Places in the Migration and the Merovingian Periods*. Uppåkrastudier, vol. 6. Acta Archaeologica Lundensia, Series in 8°, vol. 39, pp. 125–57. Almqvist & Wiksell. Stockholm.
– 2003: Beads in Scandinavia in the early and high medieval periods, CA. AD 400–1200. In: I.C. Glover, H. Hughes, J. Henderson (eds.): *Ornaments from the Past: Bead Studies after Beck*, pp. 38–46. The Bead Study Trust. London.
Callmer, J., J. Henderson 1991: Glassworking at Åhus, S. Sweden (Eighth Century AD). *Laborativ arkeologi*, vol. 5, pp. 143–54.
Campbell, E. 1991: Imported Goods in the Early-medieval Celtic West: with special reference to Dinas Powys. Unpublished PhD thesis, University of Wales, College of Cardiff. British Library Document Supply Centre Microfiche, Boston Spa.
– 2000: A Review of Glass Vessels in Western Britain and Ireland AD 400–800. In: J. Price (ed.): *Glass in Britain and Ireland AD 350–1100*. British Museum Occasional Papers, vol. 127, pp. 33–46. London.
Capelle, T. 1968: *Der Metallschmuck von Haithabu. Studien zur wikingischen Metallkunst*. Die Ausgrabungen in Haithabu, vol. 5. Wachholtz. Neumünster.
– 1976: *Die frühgeschichtlichen Metallfunde aus Domburg auf Walcheren*, vols. 1–2. Nederlandse Oudheden, ROB, vol. 5. Amersfoort.
– 1978: *Die karolingischen Funde von Schouwen*, vols. 1–2. Nederlandse Oudheden, ROB, vol. 7. Amersfoort.
– 1988: Glastransporte. In: B. Hårdh, L. Larsson, D. Olausson, R. Petré (eds.): *Trade and Exchange in Prehistory. Studies in Honour of Berta Stjernquist*. Acta Archaeologica Lundensia, Series in 8°, vol. 16, pp. 255–9. Lund.
– 1999: Zwei wikingische Modeln aus Stora Uppåkra. In: B. Hårdh (ed.): *Fynden i centrum. Keramik, glas och metall från Uppåkra*. Uppåkrastudier, vol. 2. Acta archaeologica Lundensia. Series in 8°, vol. 30, pp. 221–4. Almqvist & Wiksell. Stockholm.
Capelle, T., H. Vierck 1975: Weitere Modeln der Merowinger- und Wikingerzeit.

Frühmittelalterliche Studien, vol. 9, pp. 110–42.
Carnap-Bornheim, C. von, G. Weisgerber 2000: Karneol. *RGA*, vol. 16, pp. 285–7.
Charleston, R.J. 1963: Glass "Cakes" as Raw Material and Articles of Commerce. *Journal of Glass Studies*, vol. 5, pp. 54–67.
Christensen, T. 1991: *Lejre – syn og sagn*. Roskilde Museums Forlag. Roskilde.
Christophersen, A. 1989: Kjøpe, selge, bytte, gi. Vareutveksling og byuppkomst i Norge ca 800–1100: en modell. In: A. Andrén (ed.): *Medeltidens födelse*, pp. 109–45. Gyllenstiernska Krapperupsstiftelsen. Lund.
– 1991: Ports and trade in Norway during the transition to historical time. In: O. Crumlin-Pedersen (ed.): *Aspects of Maritime Scandinavia AD 200–1200,* pp. 159–70. The Viking Ship Museum. Roskilde.
Christophersen, A., S.W. Nordeide 1994: *Kaupangen ved Nidelva. 1000 års byhistorie belyst gjennom de arkeologiske undersøkelsenen på Folkebibliotekstomta i Trondheim 1973–1985*. Riksantikvarens skrifter, vol. 7. Oslo.
Clark, R. 2005: Glass vessels from Lundenwic. An illustration of the Contextual Approach to Fragments. *Archaeological Review from Cambridge*, vol. 20:2, pp. 82–97.
'Codex Carolinus'=Codex Carolinus. In: W. Gundlach (ed.): *Epistolae Merowingici et Karolini aevi*, vol. 1. Epistolae (in quart) edidit Societas aperiendis fontibus rerum Germanicarum medii aevi, vol. 3, pp. 469–657. Berlin 1892.
Colardelle, M., E. Verdelle 1993: *Les Habitats du lac de Paladru (Isère) dans leur environnement. La formation d'un terroire au XIe siècle*. Document d'Archéologie Française, vol. 40. Editions de la Maison des sciences de l'homme. Paris.
Cone, P. (ed.) 1977: *Treasures of Early Irish Art 1500 B.C. to 1500 A.D.* Metropolitan museum of art. New York.
Cool, H.E.M. 1994: *The quantification of Roman vessel glass assemblages*. English Heritage Report.
Cool, H.E.M., M.J. Baxter 1996: Quantifying glass assemblages. *Annales du 13e Congrès de l'Association Internationale pour l'Histoire du Verre*, pp. 93–101. Lochem.
– 1999: Peeling the onion: an approach to comparing vessel glass assemblages. *Journal of Roman Archaeology*, vol. 12, pp. 72–100.
Cool, H.E.M., J. Price 1995: *Roman vessel glass from excavations in Colchester, 1971–85*. Colchester Archaeological Report, vol. 8. Colchester.
Cosyns, P. 2005: Le verre plat romain en Belgique. *De Transparentes Spéculations. Vitres de l'Antiquité et du Haute Moyen Âge (Occident-Orient)*, pp. 49–51. Musée-site archéologique de Bavay. Bavay.
Cramp, R. 2000: Anglo-Saxon Window Glass. In: J. Price (ed.): *Glass in Britain and Ireland AD 350–1100*. British Museum Occasional Papers, vol. 127, pp. 105–14. London.
Crosby, D.D.B., J.G. Mitchell 1987: A survey of British metamorphic honestones of the 9th to 15th centuries AD in the light of potassium-argon and natural remanent magnetisation studies. *Journal of Archaeological Science*, vol. 14, pp. 483–506.
Daim, F. 2000: "Byzantinische" Gürtelgarnituren des 8. Jahrhunderts. Mit einem Beitrag von Dafydd Kidd. In: F. Daim (ed.): *Die Awaren am Rand der byzantinischen Welt*. Monographien zur Frühgeschichte und Mittelalterarchäologie, vol. 7, pp. 77–204. Innsbruck.
Danielsson, K. 1973a: Glas och halvädelsenar. In: B. Ambrosiani, B. Arrhenius, K. Danielsson, O. Kyhlberg, G. Werner: *Birka. Svarta jordens hamnområde. Arkeologisk undersökning 1970–1971*. Riksantivarieämbetet rapport C1, pp. 54–83. Stockholm.
– 1973b: Bearbetat ben och benhorn. In: B. Ambrosiani, B. Arrhenius, K. Danielsson, O. Kyhlberg, G. Werner: *Birka, Svarta jordens hamnområde. Arkeologisk undersøkning 1970–71*. Riksantivarieämbetet rapport C1, pp. 40–53. Stockholm.
Davis, M. 1993: The identification of various jet and jet-like materials used in early Bronze Age in Scotland, *Conservator*, vol. 17, pp. 11–18.
Davison, S. 2003: *Conservation and Restoration of Glass*. 2nd edition. Butterworth-Heinemann Series in Conservation and Museology. Oxford.
Dekówna, M. 1976: Glasbecher In: M. Müller-Wille (ed.): *Das Bootkammergrab von Haithabu*. Berichte über die Ausgrabungen in Haithabu, vol. 8, pp. 63–6. Wachholtz. Neumünster.
– 1990: Untersuchungen an Glasfunden aus Haithabu. In: K. Schietzel (ed.): *Das archäologische Fundmaterial*, vol. 5. Berichte über die Ausgrabungen in Haithabu, vol. 27, pp. 9–63. Wachholtz. Neumünster.
'De diversis Artibus'=Theophilus: *On Diverse arts. The foremost Medieval Treatise on Painting, Glassmaking and Metalwork*. Translated from the Latin with Introduction and Notes by J.G. Hawthorne, C.S. Smith. Dover Publications. New York, London.
Dell'Acqua, F. with D. James 2001: The Window glass. In: J. Mitchell, I.L. Hansen, C.M. Coutts (eds.): *The Finds from the 1980–86 Excavations*. San Vincenzo al Volturno, vol. 3, pp. 173–201. Centro Italiano di Studio Sull'alto Medievo. Spoleto.
Dickson, J.A.D. 1965: A modified staining technique for carbonates in thin section. *Nature*, vol. 205, pp. 587.
Dinklage, K. 1941: Frühdeutsche Volkskultur

der Ostmark im Spiegel der Bodenfunde von Untersteiermark und Krain. *Mitteilungen der Anthropologischen Gesellschaft Wien*, vol. 71, pp. 235–59.

Dolley, R.H.M. 1963: The 1871 Viking-age find of Silver Coins from Mullaghboden asa Reflection of Westfalding Intervention in Ireland. *Universitetets Oldsaksamling Årbok*, 1960–1961, pp. 49–62.

Doorninck Jr., F. van 2002: Byzantine Shipwrecks. In: A.E. Laiou (ed.): *The Economic History of Byzantium: From the Seventh through the Fifteenth Century.* Dumbarton Oaks Studies, vol. 39, pp. 900–5. Dumbarton Oaks Research Library and Collection. Washington D.C.

Duczko, W. 1985: *The filigree and granulation work of the Viking period*. Birka, vol 5. Almqvist & Wiksell. Stockholm.

Dufrenne, S. n.d. [CD-Rom]: *Les illustrations du Psaltier d'Utrecht: Sources et apport carolingien*. Association des publications près les Universités de Strasbourg Fascicule, vol. 161. Editions Ophrys. Paris.

Dungworth, D., B. Gaut, G. Wiker 2007: EDX-analyses of Viking-period glass from Søndre Kaupang, Gnr. 1012, Bnr. 9 and 10. Larvik municipality, Vestfold County. Unpublished report, KHM Archive.

Duval, N. (ed.) 1991: *Naissance des Arts Chrétienes. Atlas Archéologique de la France*. Ministère de la Culture, Paris, Picard.

Düwel, K., H. Jankuhn, H. Siems, D. Timpe (eds.) 1985: *Der Handel des frühen Mittelalters*. Untersuchungen zu Handel und Verkehr der vor- und frühgeschichtlichen Zeit im Mittel- und Nordeuropa, vol. 3. Wandenhoeck & Ruprecht. Göttingen.

– (eds.) 1987: *Der Handel der Karolinger- und Wikingerzeit*. Untersuchungen zu Handel und Verkehr der vor- und frühgeschichtlichen Zeit im Mittel- und Nordeuropa, vol. 4. Wandenhoeck & Ruprecht. Göttingen.

Eilbracht, H. 1999: *Filigran- und Granulationskunst im wikingischen Norden. Untersuchungen zum Transfer frühmittelalterlicher Gold- und Silberschmiedetechniken zwischen dem Kontinent und Nordeuropa*. Zeitschrift für Archäologie des Mittelalters, Beiheft, vol. 11. Köln.

Einarsson, S. 1944: Terms of Directions in Old Icelandic. *The Journal of English and Germanic philology*, vol. 43, pp. 265–85.

Eisenschmidt, S. 2004: *Grabfunde des 8. bis 11. Jahrhunderts zwischen Kongeå und Eider. Zur Bestattungssitte der Wikingerzeit im südlichen Altdänemark.* Studien zur Siedlungsgeschichte und Archäologie der Ostseegebiete, vol. 5. Neumünster.

Ekblom, R. 1942: Alfred the Great as Geographer. *Studia Neophilologica*, vol. 14, pp. 115–44.

Eldjárn, K. 2000 [1956]: *Kuml og haugfé. úr heidnum sid á Íslandi.* Nordri. Reykjavik.

Eldorhagen, M. 2001: Ovale spenner i Nord-Norge og Trøndelag. Stil og symbolisme i sosial sammenheng. Unpublished Master thesis, University of Tromsø.

Elias, N. 1978 [1939]: *The history of manners*. The civilizing process, vol. 1. Blackwell, Oxford.

Ellis, S.E. 1969: *The petrography and provenance of Anglo-Saxon and medieval English honestones, with notes on some other hones*. Bulletin of the British Museum (Natural history), Mineralogy, vol. 2, no. 3. London.

Ellmers, D. 1965: Zum Trinkgeschirr der Wikingerzeit. *Offa*, vol. 21/22, pp. 21–43.

– 1984: *Frühmittelalterliche Handelsschiffahrt in Mittel- und Nordeuropa*. Offa-Bücher, vol. 28. 2nd ed. Neumünster.

Endres, W., G. Riedel 2003: Königsgut und Universität – Zwei außergewöhnliche Neufunde aus Ingolstadt. *Das Archäologische Jahr in Bayern*, 2003, pp. 139–41.

Englert, A. 2007: Ohthere's voyages seen from a nautical angle. In: J. Bately, A. Englert (eds.): *Ohthere's voyages. A late 9th-century account of voyages along the coasts of Norway and Denmark and its cultural context*, pp. 117–29. The Viking Ship Museum. Roskilde.

Enright, M.J. 1996: *Lady with a Mead Cup*. Four Courts Press. Dublin.

Es, W.A. van 1990: Dorestad Centred. In: J.C. Besteman, J.M. Bos, H.A. Heidinga (eds.): *Medieval Archaeology in the Netherlands. Studies presented to H.H. van Regteren Altena*. Studies in Prae- en Protohistorie, vol. 4, pp. 151–82. Van Gorcum. Assen, Maastricht.

Es, W.A. van, W.J.H. Verwers 1975: Céramique peinte d'époque carolingienne, trouvée à Dorestad. *Berichten ROB,* vol. 25, pp. 133–64. Amersfoort.

– 1980: *The Harbour: Hoogstraat*, vol 1. Excavations at Dorestad , vol. 1. Nederlandse Oudheden, vol. 9. ROB. Amersfoort.

– 1993: Le commerce de céramiques carolingiennes aux Pays-Bas. In: D. Piton (ed.): *Travaux du Groupe de Recherches et d'Études sur la Céramique dans le Nord-Pas-de-Calais*, pp. 227–36. Nord-Ouest Archéologie Hors-Série.

Evison, V.I. 1982: Anglo-Saxon Glass Claw-beakers. *Archaeologia*, vol. 107, pp. 43–76.

– 1988a: Some Vendel, Viking and Saxon Glass. In: B. Hårdh, L. Larsson, D. Olausson, R. Petré (eds.): *Trade and Exchange in Prehistory. Studies in Honour of Berta Stjernquist.* Acta Archaeologica Lundensia, Series in 8º, vol. 16, pp. 237–45. Lund.

– 1988b: The glass. In: M. Otte (ed.): *Le vieux*

marché. Les fouilles de la Place Saint-Lambert à Liège 2, pp. 215–19. Etudes et Recherches Archéologiques de l'Université de Liège 23. Liège.
– 1989: Le verre carolingien. In: D. Foy, G. Sennequier (eds.): *À travers le verre: du moyen âge à la renaissance*, pp. 137–44. Musees et Monuments Departementaux de la Seine-Maritime, Rouen.
– 1990: Red marbled glass, Roman to Carolingian. *Annales du 11e congrès de l'Association Internationale pour l'Histoire du Verre*, pp. 217–28. Amsterdam.
– 1991: Contributions to 'Barking, Essex'. In: L. Webster, J. Backhouse (eds.): *The Making of England. Anglo-Saxon art and culture, AD 600–900*, pp. 143–5. British Museum. London.
– 1995: Early-medieval glass fragments. In: D. Phillips, B. Heywood (eds.): *From Roman fortress to Norman cathedral. Part 2: The finds*, pp. 481–3. Excavations at York Minster, vol. 1. Royal Commission on the Historical Monuments of England. London.
– 2000: Glass Vessels in England AD 400–1100. In: J. Price (ed.): *Glass in Britain and Ireland AD 350–1100*, pp. 47–104. British Museum Occasional Papers, vol. 127. London.
Falck-Muus, R. 1921: *Brynesteinsindustrien i Telemarken*. Norges Geologiske undersøkelse Årbok, vol. 5, pp. 5–179. Kristiania.
– 1957: Brynestein (og slipestein). *KLNM*, vol. 2, pp. 285–8.
Fanning, T. 1988: The Ringed Pins of Viking Europe. Unpublished PhD thesis, University College Galway.
– 1990: Die bronzenen Ringkopfnadeln aus der Ausgrabung im Hafen von Haithabu. In: K. Schietzel (ed.): *Das archäologische Fundmaterial,* vol. 5. Berichte über die Ausgrabungen in Haithabu, vol. 27, pp. 127–70. Wachholtz. Neumünster.
– 1994: *Viking Age Ringed Pins from Dublin*. Medieval Dublin Excavations 1962–81, Ser. B, vol. 4. National Museum of Ireland, Royal Irish Academy. Dublin.
– 2000: Viking Age ringed pins from Denmark. *Acta Archaeologica*, vol. 71, pp. 79–85.
Fell, C.E. 1975: Old English bēor. *Leeds Studies in English*, vol. 8, pp. 76–95.
– 1982–1983: Unfrið. An approach to a definition. *Saga Book of the Viking Society for Northern Research*, vol. 21, pp. 85–100.
Feveile, C. (ed.) 2006a: *Ribe Studier. Det ældste Ribe. Udgravninger på nordsiden af Ribe Å 1984–2000*, vol. 1.1. Jysk Arkæologisk Selskab Skrifter, vol. 51. Højbjerg.
Feveile, C., S. Jensen 2000: Ribe in the 8th and 9th Century. A Contribution to the Archaeological Chronology of North Western Europe. *Acta Archaeologica*, vol. 71, pp. 9–24.
– 2006: ASR 9 Posthuset. In: C. Feveile (ed.): *Ribe Studier. Det ældste Ribe. Udgravninger på nordsiden af Ribe Å 1984–2000*, vol.1.2. Jysk Arkæologisk selskabs Skrifter,vol. 51, pp. 119–89. Højbjerg.
Feveile, C., S. Jensen, K. Lund Rasmussen 1998: Produktion af drejet keramik i Ribeområdet i sen yngre germansk jernalder. *Kuml*, 1997–1998, pp. 143–59.
Filipowiak, W. 1985: Die Bedeutung Wolins im Ostseehandel. In: S.O. Lindquist, B. Radhe (eds.): *Society and Trade in the Baltic during the Viking Age*. Acta Visbyensiana, vol. 7, pp. 121–38. Gotlands Fornsal. Visby.
Filippucci, P., J. Mitchell, S. Cann 2001: Artifacts in silver and copper alloy. In: J. Mitchell, I.L. Hansen, C.M. Coutts (eds.): *The Finds from the 1980–86 Excavations.* San Vincenzo al Volturno, vol. 3, pp. 329–45. Centro Italiano di Studio Sull'alto Medievo. Spoleto.
Foldøy, O. (ed.) 1995: *The Museotec at AmS: Finds of Rogaland from ice age to middle ages*. AmS Småtrykk, vol. 31. Archaeological Museum of Stavanger. Stavanger.
Fomin, A. 1990: Silver of the Maghrib and Gold from Ghana at the End of the VIII–IXth Centuries A.D. In: K. Jonsson, B. Malmer (eds.): *Sigtuna Papers*, vol. 6, pp. 69–75. KVHAA. Stockholm.
Forster, A.K. 2004: Shetland and the Trade of Steatite Goods in The North Atlantic Region during the Viking and Eary Medieval Period. Unpublished PhD thesis, Department of Archaeological Sciences. University of Bradford.
Fouet, G. 1963: Agrafes à double crochet du IVème siècle dans la villa de Montmaurin Haute-Garonne. *Celticum,* vol. 6, pp. 277–92.
Foy, D., M.-D. Nenna 2001: *Tout feu tout sable. Mille ans de verre antique dans le Midi de la France.* Musées de Marseille, Editions Édisud. Marseille.
Foy, D., M. Picon, M. Vichy, V. Thirion-Merle 2003: Caractérisation des verres de la fin de l'Antiquité en Méditerranée occidentale: l'émergence de nouveaux courants commerciaux. In: D. Foy, M.-D. Nenna (eds.): *Échanges et commerce du verre dans le monde antique*. Monographies instrumentum, vol. 24, pp. 41–85. Editions Monique Mergoil. Montagnac.
Foy, D., G. Sennequier (eds.) 1989: *À travers le verre du moyen âge à la renaissance*. Exhibition catalogue from Musée des Antiquities de Seine-Maritime. Rouen.
Foy, D., M. Vichy, M. Picon 2000: Lingots de verre en Méditerranée occidentale (IIIe siècle av.J.-C. – VIIe siècle ap.J.-C.) Approvisionement et mise an œuvre Données archéologiques et

données de laboratoire. *Annales du 14e Congrès de l'Association Internationale pour l'Histoire du Verre. Italia/Venize – Milano 1998*, pp. 51–7. AIHV. Lochem.

Frandsen, L.B. 1989: En keramiklagfølge fra det ældste Ribe. Udgravninger 1985–6, Nicolaigade 8. In: *Bebyggelser og keramik fra 4.–9. århundrede*, pp. 35–42. Esbjerg Museum. Esbjerg.

– 2006: Rav. In: C. Feveile (ed.): *Det ældste Ribe. Udgravninger på nordsiden af Ribe Å 1984–2000*, vol. 1.2. Jysk Arkæologisk Selskab Skrifter, vol. 51, pp. 53–7, 161–8. Højbjerg.

Frandsen, L-, S. Jensen 1990: The Dating of Ribe´s earliest Culture Layers. The stratigraphy and dating of 8th-century Ribe. *Journal of Danish Archaeology*, vol. 7, pp. 228–30.

Frank, K. 1997: Germanen im Taubergebiet. In: K. Fuchs, M. Kempa, R. Redies (eds.): *Die Alamannen*, pp. 69–72. Theiss. Stuttgart.

Freeden, U. von 1983: Das frühmittelalterliche Gräberfeld von Grafendobrach in Oberfranken. *Berichte der Römisch-Germanischen Kommission*, vol. 64, pp. 417–507.

Freestone, I.C. 2005: The Provenance of Ancient Glass through Compositional Analysis. *Material Research Society Symposium Proceedings*, 852:OO8.1., pp. 1–14. http://www.mrs.org/s_mrs/bin.asp?CID=2724andDID=62781andDOC=FILE.PDF Site visited 15.12.07.

Freestone, I.C., M. Bimson, D. Buckton 1990: Compositional categories of Byzantine glass tesserae. *Annales du 11e congrès de l'Association Internationale pour l'Histoire du Verre*, pp. 271–9. Amsterdam.

Freestone, I.C., K.A. Leslie, M. Thirlwall, Y. Gorin-Rosen 2003: Strontium isotopes in the investigation of early glass production: Byzantine and early Islamic glass from the Near East. *Archaeometry*, vol. 45, pp. 19–32.

Freestone, I.C., M. Ponting, M.J. Hughes 2002: The Origin of Byzantine Glass from Maroni Petrera, Cyprus. *Archaeometry*, vol. 44, pp. 257–72.

Freestone, I.C., J. Price, C.R. Cartwright 2009: The batch: its recognition and significance. *Annales of the 17th Congress of the AIHV,* pp. 130–5 Aspeditions. Antwerpen.

Frydenberg, H.S. 2008: Forskning og forvaltning: Håndtering av arkeologisk massemateriale. *Primitive Tider*, vol. 10, pp. 67–77.

Fuchs, K., M. Kempa, R. Redies (eds.) 1997: *Die Alamannen*. Theiss. Stuttgart.

Fuglesang, S. 1999: Amulets as evidence for the transition from Viking to Medieval Scandinavia. D. R. Jordan, H. Montgomery and E. Thomassen (eds.): *The world of ancient magic.* Papers from the Norwegian Institute at Athens, vol. 4, pp. 299–314. Norwegian Institute at Athens. Bergen.

Fuglesang, S.H., D.M. Wilson (eds.) 2006: *The Hoen hoard. A Viking gold treasure of the ninth century.* Norske oldfunn, vol. 20. KHM. Oslo.

Gabriel, I. 1985: Brettspiel in Oldenburg vor tausend Jahren. In: K. Ehlers (ed.): *750 Jahre Stadtrecht Oldenburg in Holstein*, pp. 207–20. Felhoff-Druck. Oldenburg.

– 1988: Hof- und Sakralkultur sowie Gebrauchs- und Handelsgut im Spiegel der Kleinfunde von Starigard/Oldenburg. In: *Oldenburg – Wolin – Staraja Ladoga – Novgorod – Kiev. Handel und Handelsverbindungen im südlichen und östlichen Ostseeraum während des frühen Mittelalters*. Bericht der Römisch-Germanischen Komission, vol. 69, pp. 103–291. Philipp von Zabern. Mainz.

Gai, S. 1999: Karolingische Glasfunde der Pfaltz Paderborn. In: C. Stiegemann, M. Wemhoff (eds.): *Beitrage zum Katalog der Ausstellung, Paderborn 1999*. 799: Kunst und Kultur der Karolingerzeit. Karl der Große und Papst Leo III in Paderborn, vol. 3, pp. 212–17. Philipp von Zabern. Mainz.

Gam, T. 1991: Glasperlefremstilling i yngre jernalder og vikingetid. En analyse av teknologi og håndverk. *Eksperimentel arkæologi: Studier i teknologi og kultur*, vol. 1, pp. 153–76. Historisk Arkæologisk forsøkscenter. Lejre.

– 1992: Prehistoric Glass Technology – Experiments and Analyses. *Journal of Danish Archaeology*, vol. 9, pp. 203–13.

– 1993: Experiments in glass. Present and future. *Annales du 12e congrès de l'Association Internationale pour l'Histoire du Verre*, pp. 261–70. Amsterdam.

Gam Aschenbrenner, T. 1999: Shards for Beads? *Journal of Danish Archaeology*, vol. 13, pp. 121–32.

Gansum, T., H.-J. Hansen 2002: *Fra jern til stål: mytologiske og rituelle aspekter i teknologiske prosesser.* Midgard historisk senter. Borre.

Gaut, B. 2002: Britain and Western Scandinavia in the Vendel Period, c. 570–c. 800: The evidence of artefacts. Unpublished Master thesis, University of York.

– 2004: Glassfunnene fra Huseby, Gnr. 1032/21, Larvik Kommune, Vestfold. Utgravninger 2000–2001, C52518. Unpublished report, KHM archive.

– 2005a: Liste over kassert og omregistrert glass. Unpublished report, KHM archive.

– 2005b: A pseudo-cameo brooch-inlay from Kaupang, Southeast Norway. *Archäologisches Korrespondenzblatt*, vol. 35, pp. 545–58.

– 2006: Preliminary report. EPMA-analyses of Viking-period glass from Søndre Kaupang, Gnr. 1012, Bnr. 9 og 10, Larvik municipality, Vestfold County. Unpublished report, KHM archive.

– 2007: Vessel glass from Kaupang: a contextual and social analysis. *Norwegian Archaeological Review*, vol. 40, pp. 26–41.

– 2008: En ny parallell til et smykkeinnlegg av glass fra Kaupang. In: J. Lund, K. Chilidis, C. Prescott (eds.): *Facets of archaeology. Essays in honour of Lotte Hedeager on her 60th birthday*. Oslo Archaeological Series, vol. 10, pp. 433–8. Oslo.
– in prep.: Manors, Missionaries and Markets. Continental perspectives on Viking-period trade and exchange. PhD thesis, University of Oslo.
Gaut, B., J. Evans, J. Henderson in prep: *Scientific Analyses of the Kaupang Glass*.
Geijer, A. 1938: *Die Textilfunde aus den Gräbern*. Birka, vol. 3. Almqvist & Wiksell. Stockholm
Gelder, H.E. van 1985: De Karolingische muntvondst Roermond. *Jaarboek voor Munt- en Penningkunde*, vol. 72, pp. 15–42.
Gentili, F. 1988: L'éclairage domestique. In: J. Cuisenier, R. Guadagnin (eds.) : *Un village au temps de Charlemagne. Moines et paysans de l'abbaye de Saint-Denis du VIIe siècle à l'An Mil*, pp. 271–4. Ministère de la Culture, de la Communication, des Grand Travaux et du Bicentenaire. Éditions de la Réunion des musées nationaux. Paris.
Gerchow, J. 2005: Liudger und die angelsächsische Kirche. In: G. Isenberg, B. Rommé (eds.): *805: Liudger wird Bischof. Spuren eines Heiligen zwischen York, Rom und Münster*, pp. 141–8. Exhibition Münster 2005. Münster, Mainz.
Gerds, M. 2001a: Die Bernsteinfunde des frühmittelalterlichen Seehandelsplatzes von Gross Strömkendorf, Kreis Nordwestmecklenburg. Unpublished Master thesis, Kiel University.
– 2001b: Worked and Unworked Amber from Early Medieval Trading Places in the South-Western Baltic Region. *Offa*, vol. 58, pp. 115–22.
Gerrard, C.M. 2003: *Medieval Archaeology: understanding traditions and contemporary approaches*. Routledge. London.
Giertz, W. 1996: Middle Meuse valley ceramics of Huy-type: a preliminary analysis. *Medieval Ceramics,* vol. 20, pp. 33–64.
– 2000: Reliefbandamphoren aus St. Quirin im Kontext karolingischer Keramikk. In: M. Tauch (ed.): *Quirinus von Neuss: Beiträge zur Heiligen-, Stifts- und Münstergeschichte*, pp. 222–71. Wienand. Köln.
– 2004: Foreign influx in the formation of the Rhenish Vorgebirge pottery industries. Danubian-type wasters from Walberberg, c. 500 A.D. In: V. Hincker, P. Husi (eds.): *La Céramique du Haut Moyen Age Dans le Nord-Ouest de l'Europe Ve-Xe siècles*, pp. 289–314. Editions NEA. Caen.
Giesler, U. 1974: Datierung und Herleitung der vogelförmigen Riemenzungen. In: G. Kossack, G. Ulbert (eds.): *Studien zur vor- und frühgeschichtlichen Archäologie. Festschrift für Joachim Werner zum 65. Geburtstag*. Münchner Beiträge zur Vor- und Frühgeschichte, Ergänzungsband, vol. 1:2, pp. 521–43. Beck. München.
Gjessing, G. 1928: Finsk-ugriske vikingtids smykker i Norge. *Universitetets Oldsaksamling Årbok,* 1927, pp. 23–41.
Goll, J. 2004: Les vitreaux carolingiens de Müstair. *De Transparentes Spéculations. Vitres de l'Antiquité et du Haute Moyen Âge (Occident-Orient)*, vol. 4, pp. 86–7.
Graham-Campbell, J. 1972: Two groups of Ninth-Century Irish Brooches. *Journal of the Royal Society of Antiquaries of Ireland*, vol. 102, pp. 113–28.
– 1980: *Viking Artefacts: a select catalogue*. British Museum Publications. London.
– 1983: Some Viking-age Penannular Brooches from Scotland and the Origins of the 'Thistle-Brooch'. In: A. O'Connor, D.V. Clarke (eds.): *From Stone Age to the 'Forty-Five. Studies Presented to R.B.K. Stevenson*, pp. 310–23. Donald. Edinburgh.
– 1984: Western influences on penannular brooches and ringed pins. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde*. Birka, vol. 2:1, pp. 31–8. Almqvist & Wiksell. Stockholm.
– 1987: Western penannular brooches and their Viking Age copies in Norway: a new classification. In: J. Knirk (ed.): *Proceedings of the Tenth Viking Congress, Larkollen, Norway, 1985*. Universitetets Oldsaksamlings Skrifter, Ny rekke, vol. 9, pp. 231–46. Oslo.
– 1995: *The Viking Age Gold and Silver of Scotland*. National Museums of Scotland. Edinburgh.
– 1998: The Early Viking Age in the Irish Sea. In: H.B. Clarke, M. Ní Mhaonaigh, R. Ó Floinn (eds.): *Ireland and Scandinavia in the Early Viking Age*, pp. 104–30. Four Courts Press. Dublin.
– 1999: Rings and Things. Some observations on the Hon hoard. *Attende tværfaglige Vikingesymposium*, pp. 53–64. Hikuin. Højbjerg.
– 2001: National and Regional Identities: the 'Glittering Prizes'. In: M. Redknapp, N. Edwards, S. Youngs, A. Lane, J. Knight (eds.): *Pattern and Purpose in Insular Art*, pp. 27–38. Oxbow. Oxford.
– 2002: Tenth-Century Graves: The Viking-age Artefacts and their Significance. In: D. Freke (ed.): *Excavations on St. Patrick's Isle, Peel, Isle of Man, 1982–88: Prehistoric, Viking, Medieval and later.* Centre for Manx Studies Monographs, vol. 2, pp. 83–98. Liverpool University Press. Liverpool.
Gräslund, A.S. 1981: *The Burial Customs. A study of the graves on Björkö.* Birka, vol. 4. Almqvist & Wiksell. Stockholm.

– 2001: *Ideologi och Mentalitet. Om religionsskiftet i Skandinavien från en arkeologisk horisont*. Occasional Papers in Archaeology, vol. 29. Uppsala.

Gratuze, B., F. Tereygeol, J. Lancelot, D. Foy 2003a: Is there a relationship between some medieval lead-glass and the glassy slag produced by lead-silver mines. *Archaeometallurgy in Europe. Proceedings*, vol. 2, pp. 513–19. Associazione italiana di metallurgia. Milan.

– 2003b: Les "lissoirs" Carolingians en verre au plomb: mise en evidence de la volorisation des scories issues du traitement des galènes argentifères de Melle (Deux-Sèvres). In: D. Foy, M.-D. Nenna (eds.): *Échanges et commerce du verre dans le monde antique. Actes du colloque de l'AFAV. Aix-en-Provence et Marseille, 7–9 juin 2001*. Monographies instrumentum, vol. 24, pp. 101–8. Editions Monique Mergoil. Montagnac.

Grieg, S. 1933: *Middelalderske byfund fra Bergen og Oslo*. Det norske Videnskaps-akademi. Oslo.

Gudesen, H.G. 1980: *Merovingertiden i Øst-Norge. Kronologi, kulturmønstre og tradisjonsforløp*. Universitetets Oldsaksamling Varia, vol. 2. Oslo.

Guerrot, C. 2007: Résultats d'analyses isotopiques du plomb commun sur des matériaux archéologiques : monnaies et lissoirs. Unpublished report. Laboratoire de thermoionisation et comptage alpha MMA/ISO. N°Etude : 06-1-115-A. BRGM Service metrologie, monitoring, analyse. BP 6009 – 45060 ORLEANS Cedex 2.

Gullbekk, S.H. 2005: Natural and Money Economy in Medieval Norway. *Scandinavian Journal of History*, vol. 30, pp. 3–19.

Gustin, I. 2004: *Mellan gåva och marknad. Handel, tillit och materiell kultur under vikingatid*. Almqvist & Wiksell. Lund.

Haevernick, T.E. 1972: Zu Trierer Glasfragmenten. *Trierer Zeitschrift*, vol. 35, pp. 211–17.

Haevernick, T.E., W. Haberey 1965: Glättsteine aus Glas. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, 1963, pp. 130–8.

Hagen, A. 1994: *A handbook of Anglo-Saxon food: processing and consumption*. Reprinted with a comprehensive index. Anglo-Saxon Books. Pinner.

Hägg, I. 1971: Mantel och kjortel i vikingatidens dräkt. *Fornvännen*, pp. 141–53.

– 1974: *Kvinnodräkten i Birka: livplaggens rekonstruktion på grundval av det arkeologiska materialet*. AUN, vol. 2. Uppsala.

Hahn, K.-D. 1977: Die einheimische Keramik von Haithabu.Unpublished Doctoral thesis, Christian-Albrechts-Universität. Kiel.

Hald, N. 1991: The petrography of the honestones. In: M. Bencard, L. Bender Jørgensen, H.B. Madsen (eds.): *Ribe Excavations 1970–76*, vol. 3, pp. 142–6. Sydjysk Universitetsforlag. Esbjerg.

Hall, R. 1984: *The Viking Dig. The Excavations at York*. London, Sydney, NewYork.

Hammond, G, N. Hammond 1981: Child's play: a distorting factor in archaeological distribution. *American Antiquity*, vol. 46, pp. 634–6.

Hansen, G. 2005: *Bergen c. 800–c. 1170: The Emergence of a Town*. The Bryggen Papers Main Series, vol. 6. Fagbokforlaget. Bergen.

Hansen, S.S. 1982: „Andersminde" – en vikingetidig bebyggelse nær Ribe. *Mark og Montre. Fra sydvestjyske muséer*, 1982, pp. 25–38.

– 1996: Aspects of Viking Societies in Shetland and the Faroe Islands. In: D.J. Waugh (ed.): *Shetland's northern Link. Language and History*. The Scottish Society for Northern Studies. Edinburgh.

Hansen, U.L. 1987: *Römischer Import im Norden. Warenaustausch zwischen dem Römischen Reich und dem freien Germanien während der Kaiserzeit unter besonderer Berücksichtigung Nordeuropas*. Nordiske fortidsminder, Serie B in quarto, vol. 10. Det Kgl. Nordiske Oldskriftselskab. København.

– 1997: Faszinierendes Material. *Archäologie in Deutschland*, vol. 1997:3, pp. 18–23.

Harden, D.B. 1956: Glass Vessels in Britian and Ireland, A.D. 400–1000. In: D.B. Harden (ed.): *Dark Age Britain; Studies presented to E.T. Leeds with a bibliography of his works*, pp. 132–67. Methuen. London.

– 1961: Domestic window glass: Roman, Saxon and medieval. In: E.M. Jope (ed.): *Studies in Building History, essays in recognition of the work of B.H. St. J. O'Neil*, pp. 39–63. Odhams Press. London.

– 1976: The Glass. In: B. Cunliffe (ed.): *Saxon*. Excavations at Portchester Castle, vol. 2. Reports of the Research Committee of the Society of Antiquaries of London, vol. 33, pp. 232–4. Thames & Hudson. London.

Hårdh, B. 1976: *Wikingerzeitliche Depotfunde aus Südschweden. Katalog*. Acta archaeologica Lundensia, Series in 4°, vol. 9. Habelt. Bonn..

– 1984: Kleeblattfibeln. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde*. Birka 2:1, pp. 85–94. Almqvist & Wiksell. Stockholm.

– 1996: *Silver in the Viking Age*. Acta archaeologica Lundensia. Series in 8°, vol. 25. Almqvist & Wiksell. Stockholm.

– 1999: Näbbfibulan – ett vendeltida vardagsspänne. In: B. Hårdh (ed.): *Fynden i Centrum. Keramik, glas och metall*. Uppåkrastudier, vol. 2. Acta archaeologica Lundensia, Series in 8°, vol. 30, pp. 145–62. Almqvist & Wiksell. Stockholm..

– 2001: Produktion och spridning. Näbbfibulor i Skåne. In: B. Hårdh (ed.): *Uppåkra. Centrum och sammanhang*. Uppåkrastudier, vol. 3. Acta

archaeologica Lundensia, Series in 8°, vol. 34, pp. 187–204. Almqvist & Wiksell. Stockholm..
– 2003: Uppåkra i folkvandringstiden. In: B. Hårdh (ed.): *Fler fynd i centrum. Materialstudier i och kring Uppåkra*. Uppåkrastudier, vol. 9. Acta archaeologica Lundensia, Series in 8°, vol. 45, pp. 41–80. Almqvist & Wiksell. Stockholm.
– 2008: Hacksilver and ingots. In: D. Skre (ed.): *The Means of Exchange*. Kaupang Excavation Project Publication Series, vol. 2, pp. 95–118. Aarhus University Press. Århus.
– 2010: Viking Age Uppåkra. In: B. Hård (ed.) *Från romartida skalpeller till senvikingatida urnässpennen*. Uppåkrastudier, vol. 11. Acta archaeological Lundensia, Series in 8°, vol. 61, pp. 247–316. Almqvist & Wiksell. Stockholm.
Haseloff, G. 1951: *Der Tassilokelch*. Münchner Beiträge zur Vor- und Frühgeschichte, vol. 1. Beck'sche. München.
– 1978: Der Einband des Ragyndrudis-Codex in Fulda, Codex Bonifatianus 2. In: A. Brall (ed.): *Von der Klosterbibliothek zur Landesbibliothek*, pp. 1–46. Stuttgart.
– 1980: Die frühmittelalterlichen Chorschrankenfragmente in Müstair. *Helvetia Archaeologica*, vol. 11, pp. 21–39.
– 1990: *Email im frühen Mittelalter. Frühchristliche Kunst von der Spätantike bis zu den Karolingern*. Marburger Studien zur Vor- und Frühgeschichte. Sonderband 1. Hitzeroth. Marburg.
Hatz, G. 1974: *Handel und Verkehr zwischen dem Deutschen Reich und Schweden in der späten Wikingerzeit. Die deutschen Münzen des 10. und 11. Jahrhunderts*. KVHAA. Stockholm.
Haugen, E. 1957: The Semantics of Icelandic Orientation. *Word*, vol. 13, pp. 447–60.
Hayden, B., A. Cannon 1983: Where the Garbage Goes: Refuse Disposal in the Maya Highlands. *Journal of Anthropological Archaeology*, vol. 2, pp. 117–63.
Hayward, J. 1972: Painted Windows. Techniques of Stained Glass. *The Metropolitan Museum of Art Bulletin*, vol. 30, pp. 98–108.
Hedeager Krag, A. 1994: Dragtudviklingen fra 8.–10. Årh. e. Kr. i Sydskandinavien – med udgangspunkt i de skålformede spænder. *Lag*, vol. 5, pp. 7–71.
Helgesson, B. 1999: HELGE – ett spår av en tidig kristen mision i Uppåkra? In: B. Hårdh (ed.): *Fynden i Centrum. Keramik, glas och metall.* Uppåkrastudier, vol. 2. Acta archaeologica Lundensia, Series in 8°, vol. 30, pp. 191–200. Almqvist & Wiksell. Stockholm.
Helland, A. 1893: *Tagskifere, heller og vekstene.* Norges geologiske undersøgelse, vol. 10. Aschehoug. Kristiania.
Helle, K. 1982: *Kongssete og kjøpstad. Fra opphavet til 1536*. Bergen bys historie, vol. 1. Universitetsforlaget. Oslo.
Hencken, H. 1953: Lagore Crannog: an Irish royal residence of the 7th to 10th centuries A.D. *Proceedings of the Royal Irish Academy. Section C*, vol. 53, pp. 1–247.
Henderson, J. 1999: Technological aspects of Anglo-Saxon glass beads. In: M. Guido, M.G. Welch (eds.): *The Glass Beads of Anglo-Saxon England c.AD 400–700. A preliminary visual classification of the more definitive and diagnostic types.* Reports of the Research Committee of the Society of Antiquaries of London, vol. 58, pp. 81–93. Boydell Press. Woodbridge.
– 2000: *The Science and Archaeology of Materials: An investigation of inorganic materials.* Routledge. London.
– 2002: Tradition and Experiment in First Millennium A.D. Glass Production – The Emergence of Early Islamic Glass technology in Late Antiquity. *Accounts of Chemical Research*, vol. 35, pp. 594–602.
– 2003: Glass trade and chemical analysis: a possible model for Islamic glass production. In: D. Foy, M.-D. Nenna (eds.): *Échanges et commerce du verre dans le monde antique. Actes du colloque de l'AFAV. Aix-en-Provence et Marseille, 7–9 juin 2001*, pp. 109–23. Monographies instrumentum, vol. 24. Editions Monique Mergoil. Montagnac.
Henderson, J., I. Holand 1992: The Glass from Borg, an Early-medieval Chieftain's Farm in Northern Norway. *Medieval Archaeology*, vol. 36, pp. 29–58.
Henderson, J., S.D. McLoughlin, D.S. McPhail 2004: Radical Changes in Islamic Glass Technology: Evidence for Conservatism and Experimentation with new Glass Recipes from Early and Middle Islamic Raqqa, Syria. *Archaeometry*, vol. 46, pp. 439–69.
Henricson, L.G. 1993: Glass: In: L.H. Olausson (ed.): *Aspects on Birka: Investigations and surveys 1976–1989*. Theses and papers in archaeology, Series B 3, pp. 143–7. Archaeological Research Laboratory, University of Stockholm.
– 1995: Broken glass beakers re-used as glass beads? In: M. Rasmussen, U.L. Hansen, U. Näsman (eds.): *Glass Beads – Cultural History, Technology, Experiment and Analogy.* Studies in Technology and Culture, vol. 2, pp. 13–17. Lejre.
Hepp, D.A. 2007: Die Bergkristall- und Karneolperlen von Haithabu und Schleswig. Ein Beitrag zu Handel und Handwerk im südlichen Ostseeraum. In: K. Schietzel (ed.): *Das archäologische Fundmaterial*, vol. 8. Berichte über die Ausgrabungen in Haithabu, vol. 36, pp. 13–181. Wachholtz. Neumünster.
Herlihy, D. 1990: *Opera muliebria. Women and Work in Medieval Europe*. McGraw Hill New York.

Herrmann, J. 1995: Frühe Seehandelsplätze am äussersten Ende des westlichen Ozeans”. Geschichtliche Grundlagen, siedlungstopographische Strukturen und ethnische Herkunft ihrer Bewohner. *Acta Praehistorica et Archaeologica*, vol. 26/27,1994/95, pp. 57–72.
– 2005: *Ralswiek auf Rügen. Die slawisch-wikingischen Siedlungen und deren Hinterland.* Teil III – Die Funde aus der Hauptsiedlung. Beiträge zur Ur- und Frühgeschichte Mecklenburg-Vorpommerns, vol. 37. Schwerin.
Heyerdahl-Larsen, B. 1979a: Spor av østlige kulturkontakter i Vestfolds vikingtid: 3 hesteskoformete spenner fra Kaupang. *Viking*, vol. 42, pp. 115–27.
– 1979b: Import av halvedelstener til Kaupang. *Universitetets Oldsaksamling Årbok,* 1979, pp. 150–7. Oslo.
– 1999: Perler. Tilvirkning, proveniens. In: C. Blindheim, B. Heyerdahl-Larsen, A.S. Ingstad: *Gravplassene i Bikjholbergene/Lamøya. Undersøkelsene 1950–1957. Del B: Oldsaksformer. Kulturhistorisk tilbakeblikk. Del C: Tekstilene*. Kaupang-funnene, vol. 2:B, C. Norske oldfunn, vol. 19, pp. 59–70. UKM, Oldsaksamlingen. Oslo.
Hinton, D.A., R. White 1993: The Metalworkers Hoard from Tattershall Thorpe, Lincolnshire. *Anglo-Saxon England*, vol. 22, pp. 147–66.
Hjermind, J., M. Iversen, D.E. Robinson 2005: "vuiberge hic coronatur rex dacie". In: M. Iversen, D.E. Robinson, J. Hjermind, C. Christensen (eds.): *Viborg Søndersø 1018–1030. Arkæologi og naturvidenskab i et værkstedsområde fra vikingetid*, pp. 553–63. Viborg Stiftsmuseum. Århus.
Hodges, R. 1981: *The Hamwih pottery. The local and imported wares from 30 years' excavations at Middle Saxon Southampton and their European context*. CBA Research Report 37. London.
– 1982: *Dark Age Economics. The Origins of Towns and Trade AD 600–1000*. Duckworth. London.
– 1991: A fetishism for commodities: ninth-century glass-making at San Vincenzo al Volturno. In: M. Mendera (ed.): *Archeologia e Storia della Produzione del Vetro Preindustriale*, pp. 67–90. Insegna del Giglio. Florence.
Hoffmann, M. 1964: *The warp-weighted loom*. Norwegian University Press. Oslo.
Høie, K. 2006: Drikkeglass fra Brygge-utgravningen fra 1170–1702. Unpublished Master thesis, University of Bergen.
Holand, I. 2001: *Sustaining Life. Vessel Import to Norway in the first millennium AD.* Ams-Skrifter, vol. 17. Arkeologisk museum i Stavanger. Stavanger.
– 2003a: Glass vessels. In: G.S. Munch, O.S. Johansen, E. Roesdahl (eds.): *Borg in Lofoten. A chieftain's farm in North Norway*, pp. 211–29. Tapir. Trondheim.
– 2003b: Pottery. In: G.S. Munch, O.S. Johansen, E. Roesdahl (eds.): *Borg in Lofoten. A chieftain's farm in North Norway*, pp. 199–210. Tapir. Trondheim.
Holmqvist, W. (ed.) 1964: *Report for 1954-1956*. Excavations at Helgö, vol. 1. KVHAA. Almqvist & Wiksell. Stockholm.
– (ed.) 1970: *Report for 1960-1964*. Excavations at Helgö, vol. 3. KVHAA. Almqvist & Wiksell. Stockholm.
Hougen, E.K. 1960: Tinnfoliert keramikk fra Kaupang. *Universitetets Oldsaksamling Årbok,* 1958–1959, pp. 91–105. Oslo.
– 1968: Glassbegre i Norge fra sjette til tiende århundre. *Viking*, vol. 32, pp. 85–109.
– 1969a: Glassmaterialet fra Kaupang. *Viking*, vol. 33, pp. 119–37.
– 1969b: Leirkarmaterialet fra Kaupang. *Viking*, vol. 33, pp. 97–118.
– 1993: *Bosetningsområdets keramikk.* Kaupang-funnene 3:B. Norske oldfunn, vol. 14. IAKN, Oldsaksamlingen. Oslo.
– n.d.: Hand list. Glass finds from Blindheim's excavation in the settlement area. Unpublished document, KHM Archive.
– in prep: 'Glassmaterialet fra Kaupangs bosetningsområde'. To appear in *Norske oldfunn,* KHM. Oslo.
Hübener, W. 1959: *Die Keramik von Haithabu.* Die Ausgrabungen in Haithabu, vol. 2. Wachholtz. Neumünster.
– 1971: Merowingerzeitliche Kettenschmuckträger in Westeuropa. *Madrider Mitteilungen*, vol. 12, pp. 241–61.
– 1972: Gleicharmige Bügelfibeln der Merowingerzeit in Westeuropa. *Madrider Mitteilungen*, vol. 13, pp. 211–69.
Hunter, F. 2008: Jet and Related Materials in Viking Scotland. *Medieval Archaeology*, vol. 52, pp. 103–18.
Hunter, F., J.G. McDonnell, A.M. Pollard, C.R. Morris, C.C. Rowlands 1993: The scientific identification of archaeological jet-like artefacts, *Archaeometry,* vol. 35:1, pp. 69–89.
Hunter, F., B. Russel 2001: Jet. In: K.L. Michell, K.R. Murdoch, J.R. Ward (eds.): *Fast Castle Excavations 1971–86*, pp. 117–21. Edinburgh Archaeological Field Society. Edinburgh.
Hunter, J.R. 1972: A brief discussion concerning certain methodological difficulties in the study of glass vessel of the Scandinavian prehistoric period. *Meddelanden från Lunds Universitets Historiska Museum,* 1971–72, pp. 163–77.
– 1975: Glasses from Scandinavian burials in the first millennium AD. *World Archaeology*, vol. 7, pp. 79–86.

– 1977: Scandinavian Glasses of the First Millennium AD – A Typological and Physical Examination. Unpublished PhD thesis, University of Durham. British Library microfiche, British Library's Document Supply Centre, Boston Spa.
– 1980: The Glass. In: P. Holdsworth, D.A. Hinton (eds.): *Excavations at Melbourne Street, Southampton, 1971–76*. CBA Research Report vol. 33, pp. 59–72. London.
Hunter, J.R., M.P. Heyworth 1998: *The Hamwic Glass.* CBA Research report, vol. 119. York.
Hunter, J.R., C. Jackson 1993: Glass. In: N.S.H. Rogers (ed.): *Anglian and Other Finds from Fishergate*. The Archaeology of York. The Small Finds Fascicule 17:9, pp. 1331–44. York Archaeological Trust. York.
Hybel, N., B. Poulsen 2007: *The Danish resources c. 1000–1550. Growth and recession*. Brill. Leiden.
Ilkjær, J. 1993: Waffen aus Lundeborg. Ein Vergleich von Siedlungs- und Opferfunden. In: P.O. Nielsen, K. Randsborg, H. Thrane (eds.): *The Archaeology of Gudme and Lundeborg*, pp. 109–17. Akademisk forlag. København.
Ingemark, D. 1995: Glasblåsning – ett tidigt hantverk i Skandinavien? *Fornvännen*, vol. 90, pp. 241–8
Ingstad, A.S. 1999: Tekstilene. In: C. Blindheim, B. Heyerdahl-Larsen, A.S. Ingstad 1999: *Gravplassene i Bikjholbergene/Lamøya. Undersøkelsene 1950–1957. Del B Oldsaksformer. Kulturhistorisk tilbakeblikk. Del C. Tekstilene*. Norske oldfunn, vol. 19, pp. 219–72. UKM. Oslo.
Isenberg, G., B. Rommé (eds.) 2005: *805: Liudger wird Bischof. Spuren eines Heiligen zwischen York, Rom und Münster*, pp. 141–8. Exhibition Münster 2005. Münster, Mainz.
Isings, C. 1980: Glass Finds from Dorestad, Hoogstraat I. In: W.A. van Es, W.J.H. Verwers (eds.): *The Harbour: Hoogstraat I*. Excavations at Dorestad, vol. 1. Nederlandse Oudheden, vol. 9, pp. 225–37. ROB. Amersfoort.
Iversen, M., D.E. Robinson, J. Hjermind, C. Christensen (eds.) 2005: *Viborg Søndersø 1018–1030. Arkæologi og naturvidenskab i et værkstedsområde fra vikingetid*. Viborg Stiftsmuseum. Århus.
Jackson, C. 1996: A new start of many happy returns. *Annales du 13e congrès de l'Association Internationale pour l'Histoire du Verre*, pp. 289–301. Lochem.
James, L. 2006: Byzantine glass mosaic tesserae: some material considerations. *Byzantine and modern Greek studies*, vol. 30, pp. 29–47.
Jankuhn, H. 1934: Kunstgewerbe in Haithabu. *IPEK, Jahrbuch für prähistorische und ethnographische Kunst*, pp. 105–18.
– 1943: *Die Ausgrabungen in Haithabu (1937–1939). Vorläufiger Grabungsbericht*. Deutsches Ahnenerbe, vol. 3. Berlin-Dahlem.
– 1986: *Haithabu. Ein Handelsplatz der Wikingerzeit*. 8th edition. Wachholz. Neumünster.
Janssen, W. 1987: *Die Importkeramik von Haithabu.* Die Ausgrabungen in Haithabu, vol. 9. Wachholtz. Neumünster.
Jansson, I. 1984a: Kleine Rundspangen. In: G. Arwidsson (ed.): *Systematiche Analysen der Gräberfunde*. Birka 2:1, pp. 58–74. Almqvist & Wiksell. Stockholm.
– 1984b: Grosse Rundspangen. In: G. Arwidsson (ed.): *Systematiche Analysen der Gräberfunde.* Birka 2:1, pp. 75–84. Almqvist & Wiksell. Stockholm.
– 1985: *Ovala spännbucklor. En studie av vikingatida standardsmycken med utgångspunkt från Björkö-fynden*. AUN, vol. 7. Uppsala.
– 1987: Communications between Scandinavia and Eastern Europe in the Viking Age. The archaeological evidence. In: K. Düwel, H. Jankuhn, H. Siems, D. Timpe (eds.): *Der Handel der Karolinger- und Wikingerzeit.* Untersuchungen zu Handel und Verkehr der vor- und frühgeschichtlichen Zeit im Mittel- und Nordeuropa, vol. 4, pp. 773–807. Wandenhoeck & Ruprecht. Göttingen.
– 1988: Wikingerzeitlicher orientalischer Import in Skandinavien. In: *Oldenburg – Wolin – Staraja Ladoga – Novgorod – Kiev. Handel und Handelsverbindungen im südlichen und östlichen Ostseeraum während des frühen Mittelalters.* Bericht der Römisch-Germanischen Komission, vol. 69, pp. 564–647. Phillipp von Zabern. Mainz.
– 1991: År 970/971 och vikingatidens kronologi. In: M. Iversen (ed.): *Mammen. Grav, kunst og samfund i vikingetid.* Jysk Arkæologisk Selskabs Skrifter, vol. 28, pp. 267–84. Aarhus.
Jensen, J. 2000: *Rav. Nordens guld.* Gyldendal. København.
– 2004: *Yngre jernalder og Vikingetid 400 e. Kr.–1050 e. Kr.* Danmarks Oldtid, vol. 4. Gyldendal. København.
Jensen, S. 1991: *Ribes Vikinger*. Den antkvariske Samling. Ribe.
Jones, R., V. Olive, R. Ellam 2006: Chemical (rare earth element) analysis of Viking steatite artefacts from Kaupang: a preliminary report. Unpublished report, KHM archive. Oslo.
Jones, R., O. Olive, V. Kilikoglou, R. Ellam, Y. Bassiakos, I.S.J. Bray, D.C.W. Sanderson 2007: New protocol for the chemical characterisation of steatite: two case studies in Europe: the Shetland Isles and Crete. *Journal of Archaeological Science*, vol. 34, pp. 626–41.
Jørgensen, L. 1993: The Find Material from the

Settlement of Gudme II – Composition and Interpretation. In: P.O. Nielsen, K. Randsborg, H. Thrane (eds.): *The Archaeology of Gudme and Lundeborg*, pp. 53–63. Akademisk forlag. København.
– 1994: Fibel und Fibeltracht. *RGA*, vol. 8, pp. 524–36.
Jørgensen, L., L. Pedersen 1996: Vikinger ved Tissø. Gamle og nye fund fra et handels- og håndværkscentrum. *Nationalmuseets Arbejdsmark*, 1996, pp. 22–36.
Jørgensen, L., P. Vang Petersen 1998: *Guld, magt och tro. Danske skattefund fra oldtid og middelalder.* Nationalmuseet. København.
Jouttijärvi, A. 2002: Kobberlegeringer i jernalder og vikingetid. In: M.B. Henriksen (ed.): *Metalhåndværk og håndværkspladser fra yngre germansk jernalder, vikingetid og tidlig middelalder.* Skrifter fra Odense Bys Museer, vol. 9. pp. 27–40. Odense.
– 2005: Smeltedråper af bly fra Kaupang. Analyse af Pb-isotoper. Heimdal-archaeometry. Unpublished report, KHM archive.
– 2006: Bly fra Kaupang. Analyse af Pb-isotoper. Heimdal-archaeometry. Unpublished report, KHM archive.
Jouttijärvi, A., T. Thomsen, A.S.A. Moltsen 2005: Værkstedets funktion. In: M. Iversen, D.E. Robinson, J. Hjermind, C. Christensen (eds.): *Viborg Søndersø 1018–1030. Arkæologi og naturvidenskab i et værkstedsområde fra vikingetid*, pp. 297–320. Viborg Stiftsmuseum. Århus.
Jülich, T. 1999: Ardennenkreuz. In: C. Stiegemann, M. Wemhoff (eds.): *799 – Kunst und Kultur der Karolingerzeit. Karl der Große und Papst Leo III. in Paderborn*, vol. 2, pp. 797–802. Philipp von Zabern. Mainz.
Kars, H. 1983: Early-medieval Dorestad, an archaeo-petrological study. Part V: The whetstones and the touchstones. *Berichten ROB*, vol. 33, pp. 1–37. Amersfoort.
Kars, H., J.M.A.R. Wevers 1983a: Early-Medieval Dorestad, an Archaeo-Petrological Study. Part III: A Trachyte Mortar, the Soapstone Finds, and the Tuyères. *Berichten ROB*, vol. 32. pp. 169–82. Amersfoort.
– 1983b: Early-Medieval Dorestad, an Archaeo-Petrological Study. Part VII: Amber. *Berichten ROB*, vol. 33, pp. 61–81. Amersfoort.
Keene, D.J. 1982: Rubbish in medieval towns. In: A.R. Hall, H.K. Kenward (eds.): *Environmental archaeology in the urban context.* CBA Research Report, vol. 43. London.
Kemp, R.L. 1996: *Anglian settlement at 46–54 Fishergate*. The Archaeology of York. Fascicule 1. York Archaeological Trust. York.
Kilger, C. 2008a: Kaupang from afar. Aspects of the Interpretation of Dirham Finds in Northern and Eastern Europe between the Late 8th and Early 10th Centuries. In: D. Skre (ed.): *Means of exchange*. Kaupang Excavation Project Publication Series, vol. 2, pp. 199–252. Aarhus University Press. Århus.
– 2008b: Wholeness and Holiness – Counting, Weighing and Valuing Silver in the Early Viking Period. In: D. Skre (ed.): *Means of exchange*. Kaupang Excavation Project Publication Series, vol 2, pp. 253–325. Århus.
– 2008c: Kombinationer av föremål – de vikingatida mittspennedepåerna. In: K. Chilidis, J. Lund, C. Prescott (eds.): *Facets of Archaeology. Essays in honour of Lotte Hedeager on her 60th birthday.* Oslo Archaeological Series, vol. 10, pp. 323–38. Unipub Academic Press. Oslo.
Kind, T., K.H. Wedepohl, A. Kronz 2003: Karolingerzeitliches Glas und verschiedene Handwerksindizien aus dem Kloster Fulda. *Zeitschrift für Archäologie des Mittelalters*, vol. 31, pp. 61–93.
Koch, A. 1998: Fremde Fibeln im Frankenreich. Ein Beitrag zur Frage nichtfränkischer germanischer Ethnien in Nordgallien. *Acta Praehistorica et Archaeologica*, vol. 30. pp. 69–89.
Koch, U. 1996: Die fränkische Expansion ins Main- und Neckargebiet. In: K. von Welck, A. Wieczorek, H. Ament (eds.): *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 270–84. Philipp von Zabern. Mainz.
– 1997: Ethnische Vielfalt im Südwesten. Beobachtungen in merowingerzeitlichen Gräberfeldern an Neckar und Donau. In: K. Fuchs, M. Kempa, R. Redies (eds.): *Die Alamannen,* pp. 219–32. Theiss. Stuttgart.
Kock, J., T. Sode 1994: *Glas, glasperler og glasmagere i Nordindien*. Bygd, vol. 23:3. Esbjerg.
Koehler, W. 1960: *Die Gruppe des Wiener Krönungs-Evangeliars. Metzer Handschriften*. Die karolingischen Miniaturen, vol. 3. Berlin.
Korhammer, M. 1985: The orientation system in the Old English Orosius: shifted or not? In: M. Lapidge, P. Clemoes, H. Gneuss (eds.): *Learning and literature in Anglo-Saxon England*, pp. 251–69. Cambridge University Press. Cambridge.
Kornbluth, Genevra 1995: *Engraved Gems of the Carolingian Empire.* The Pennsylvania State University Press. University Park, PA.
Kresten, P. 2008: Geological analyses of selected stone artefacts from Helgö. In: H. Clarke, K. Lamm (eds.): *Workshop. Part III*. Excavations at Helgö, vol. 17, pp. 147–57. KVHAA. Almqvist & Wiksell. Stockholm.
Kresten, P., E. Hjärthner-Holdar, H. Harryson 2001: *Metallurgin i Uppåkra: icke-järnmetaller under tusen år. LUHM 31000, Uppåkra sn, Skåne.* Analysrapport 10-2001. RAÄ, UV GAL. Uppsala.

Kristensen, S. 2007: Brettspillet – jernalderkrigerens virtuelle arena: strategispill i sørøstnorsk jernalder. Unpublished Master thesis, IAKH, University of Oslo.

Kristensen, S., Berg-Hansen, I.-M. 2005: Kaupangregistreringen vår 2005. Larvik Kommune, Vestfold Fylke. Unpublished report, KHM Archive.

Kroker, M. 2005: Die Siedlung Mimigernaford und die "Domburg" im 9. und 10. Jahrhundert. In: G. Isenberg, B. Rommé (eds.): *805: Liudger wird Bischof. Spuren eines Heiligen zwischen York, Rom und Münster*, pp. 229–42. Exhibition Münster 2005. Münster, Mainz.

Krueger, I., K.H. Wedepohl 2003: Composition and shapes of glass of the early medieval period (8th to 10th century AD) in Central Europe. In: D. Foy, M.-D. Nenna (eds.): *Échanges et commerce du verre dans le monde antique. Actes du colloque de l'AFAV. Aix-en-Provence et Marseille, 7–9 juin 2001*, pp. 93–100. Monographies instrumentum, vol. 24. Editions Monique Mergoil. Montagnac.

Kyhlberg, O. 1980: *Helgö och Birka: kronologisk-topografisk analys av grav- och boplatser*. Arkeologiska rapporter och meddelanden från Institutionen för arkeologi, Stockholms universitet, vol. 6. Stockholm.

La Baume, P. 1952–1953: Die Wikingerzeit auf den Nordfriesischen Inseln. *Jahrbuch des nordfriesischen Vereins für Heimatkunde und Heimatliebe*, vol. 29, pp. 5–185.

Lamm, J.P. 2008: An introduction to the lithic material from Helgö with special emphasis on the stone artefacts from Building Group 3. In: H. Clarke, K. Lamm (eds.): *Workshop. Part III*. Excavations at Helgö, vol. 17, pp. 89–129. KVHAA. Almqvist & Wiksell. Stockholm.

Lamm, K. 2008: Crucibles and cupels from Building Group 3. In: H. Clarke, K. Lamm (eds.): *Workshop. Part III*. Excavations at Helgö, vol. 17, pp. 171–207. Stockholm.

Larsen, J.H. 2004: Jernvinna på Østlandet i yngre jernalder og middelalder – noen kronologiske problemer. *Viking*, vol. 62, pp. 139–70.

Larsson, S. 2000: *Stadens dolda kulturskikt. Lundarkeologins förutsättningar och förståelsehorisonter uttryckt genom praxis för källmaterialsproduktion 1890–1990*. Archaeologica Lundensia: investigationes de antiqvitatibus urbis Lundae, vol. 9. Kulturhistoriska museet. Lund.

Laux, F. 1983: Der Reihengräberfriedhof in Oldendorf, Samtgemeinde Amelinghausen, Kr. Lüneburg/Niedersachsen. *Hammaburg N.F.*, vol. 5, pp. 91–147. Neumünster.

– 1996: Die Sachsen – Nachbarn und Gegenspieler der Franken. In: K. von Welck, A. Wieczorek, H. Ament (eds.): *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 331–7. Philipp von Zabern. Mainz.

Lebecq, S. 1992: The Frisian trade in the Dark Ages: a Frisian or a Frankish/Frisian trade? : *Teksten van lezingen gehouden tijdens het symposium "Handel, handelsplaatsen en handelswaar vanaf de Vroege Middeleeuwen in de Lage Landen" te Rotterdam van 2 t/m 3 november 1990*. Rotterdam Papers, vol. 7, pp. 7–15. Rotterdam.

– 1998: Friesenhandel. *RGA*, vol. 10, pp. 69–80.

Lehner, H., W. Bader 1932: Baugeschichtliche Untersuchungen am Bonner Münster. *Bonner Jahrbücher*, vol. 136–7, pp. 1–216. Bonn.

Lennartsson, M. 1999: Karoligische Metallarbeiten mit Pflanzenornamentik. *Offa*, vol. 54–5, pp. 431–619.

Lehtosalo-Hilander, P.-L. 1982: *The Artefacts*. Luistari, vol. 2. Finska Fornminnesföreningens Tidskrift, vol. 82:2. Helsinki.

Lindell, M., J. Thomasson 2003: Tell me more. Om karaktären av kulturlagerkonstruktionerna i Uppåkra i jämförande och tematiska perspektiv. In: M. Anglert, J. Thomasson (eds.): *Landskapsarkeologi och tidig medeltid – några exempel från södra Sverige*. Uppåkrastudier, vol. 8. Acta Archaeologica Lundensia, Series in 8°, vol. 41, pp. 11–70. Almqvist & Wiksell. Stockholm.

Linder, A. 1967: *Spinnen und Weben einst und jetzt*. Bucher. Luzern.

Lindquist, M. 1984: Spielsteine, Würfel und Spielbretter. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde*. Birka 2:1, pp. 215–18. Almqvist & Wiksell. Stockholm.

– 2003: A tool for making beads. *Viking Heritage Magazine*, vol. 2003:3, p. 20.

Lobbedey, U., F. Dell'Acqua, K.H. Wedepohl 2001: Coloured Glass Wall Tiles from Corvey (Germany): Carolingian or Romanesque? *Journal of Glass Studies*, vol. 43, pp. 89–105.

Lödöen, T.K. 1993: Et gravfunn fra sein steinalder. *Arkeo. Nytt fra Historisk museum i Bergen*, 1993:2, pp. 4–7.

Löfgren, J. 1973: Die mineralogische Untersuchung der Granaten von Paviken auf Gotland. *Early Medieval Studies*, vol. 6. Antikvariskt arkiv, vol. 53, pp. 78–96. Stockholm.

Lønaas, O.C. 2001: Brynestein i middelalderen. En analyse av brynematerialet fra Oslogate 6. Unpublished Master Thesis, Universitety of Oslo.

Lønning, S. 1976: *Spinne ull på rokk og håndtein*. Landbruksforlaget. Oslo.

Lossius, S.M. 1977: *Kleberkarmaterialet fra Borgund*. Arkeologiske avhandlinger, Historisk Museum, Universitetet i Bergen, vol. 1. Bergen.

Loveluck, C.P. 2001: Wealth, Waste and Conspicuous Consumption. Flixborough and its

importance for Middle and Late Saxon rural settlement studies. In: H. Hamerow, A. MacGregor (eds.): *Image and Power in the Archaeology of Early-medieval Britain. Essays in honour of Rosemary Cramp*, pp. 78–130. Oxbow. Oxford.
Lund, N. 1987: Peace and Non-Peace in the Viking Age. Ottar in Biramaland, the Rus in Byzantium, and Danes and Norwegians in England. In: J.E. Knirk (ed.): *Proceedings of the Tenth Viking Congress*. Universitetets Oldsaksamlings Skrifter, vol. 9, pp. 255–69. Oslo.
Lund Feveile, L. 2006: Hulglasskår fra markedspladsen i Ribe, ASR 9 Posthuset. In: C. Feveile (ed.): *Det ældste Ribe. Udgravninger på nordsiden af Ribe Å 1984–2000*, vol. 1.1. Jysk Arkæologisk Selskabs Skrifter,vol. 51, pp. 195–277. Højbjerg.
Lunden, K. 1999: Money Economy in Medieval Norway. *Scandinavian Journal of History*, vol. 24, pp. 245–65.
Lundquist, L. 1996: Slöinge- en stormandsgård från järnåldern. In: L. Lundqvist, K. Lindeblad, A.-L. Nielsen, L. Ersgård (eds.) 1996: *Slöinge och Borg. Stormansgårdar i öst och väst*. Riksantikvarieämbetet. Arkeologiska Undersökningar. Skrifter, vol. 18. Stockholm.
Lundström, A.: 1971: Cuppa vitrea auro ornate. *Early Medieval Studies*, vol. 3. Antikvariskt arkiv, vol. 40, pp. 52–68. Stockholm.
– 1976: *Beadmaking in Scandinavia in the Early Middle Ages*. Early Medieval Studies, vol. 9. Antikvariskt Arkiv, vol. 61. Stockholm.
– 1981: Survey of the glass from Helgö. In: H. Clarke, K. Lamm (eds.): *Glass – Iron – Clay*. Excavations at Helgö, vol. 7, pp. 1–38. KVHAA. Almqvist & Wiksell. Stockholm.
Lundström, P. 1973: Almandingranaten von Paviken auf Gotland. *Early Medieval Studies*, vol. 6. Antikvariskt Arkiv, vol. 53, pp. 67–77. Stockholm.
– 1981: *De kommo vida. Vikingars hamn vid Paviken på Gotland*. Statens sjöhistoriska museum. Stockholm.
Lutovský, M. 1994: Kolínský knízecí hrob: Ad fontes – Fürstengrab von Kolín: Ad fontes. *Sborník Národního Muzea v Praze*, vol. 48, pp. 37–76. Prague.
Lyngstrøm, H. 2008: *Danske jern. En kulturhistorisk analyse af fremstilling, fordeling og forbrug*. Kongelige Nordiske Oldskriftselskab. København.
MacGregor, A., A.J. Mainman, N.S.H. Rogers 1999: *Craft, Industry and Everyday Life: Bone, Antler, Ivory and Horn from Anglo-Scandinavian and Medieval York*. The Archaeology of York. The Small Finds, vol. 17:12. York Archaeological Trust. York.
Madsen, H.B. 1984: Metal-casting Techniques, Production and Workshops. In: M. Benchard (ed.): *Ribe Excavations 1970–76*, vol. 2, pp. 15–189. Sydjysk Universitetsforlag. Esbjerg.
Madsen, H.J. 1991: Vikingetidens keramik som historisk kilde. In: P. Mortensen, B.M. Rasmussen (eds.): *Høvdingesamfund og kongemagt*. Fra stamme til stat i Danmark, vol. 2. Jysk Arkæologisk Selskabs Skrifter, vol. 22:2, pp. 217–34. Højbjerg.
– 2004: Pottery from the 8th–9th centuries. In: M. Bencard, A.K. Rasmussen, H. Brinch Madsen (ed.): *Ribe excavations 1970–76*, vol. 5, pp. 223–70. Jutland Archaeological Society, vol. 46. Højbjerg.
Mägi-Lõugas, M. 1994: Eesti Viikingaegsed Hoburaudsõled Ja Nende Ornament. *Eesti TA Toim. Humanitaar- ja Sotsiaalteadused*, vol. 43:4, pp. 465–84.
Magnus, B. 2003: The importance of Amber in the Viking Period in the Nordic Countries. *Amber in Archaeology*, pp. 126–38. Institute of the History of Latvia Publishers. Riga.
Magnus, O. 1963 [1555]: *Olaus Magnus. Historia om de nordiska folken*. Almqvist & Wiksell. Uppsala.
Mainman, A.J., N.S.H. Rogers 2000: *Craft, industry and everyday life: Finds from Anglo-Scandinavian York*. The Archaeology of York. The small finds, vol. 17:14. York Archaeological Trust. London.
– 2004: Craft and Economy in Anglo-Scandinavian York. In: R. Hall (ed.): *Aspects of Anglo-Scandinavian York*. The Archaeology of York. Anglo-Scandinavian York Fascicule 8:4, pp. 459–87. York Archaeological Trust. York.
Maixner, B. 2004: Die tierverzierte Metallarbeiten der Wikingerzeit aus Birka under besonderer Berücksichtigung des Borrestils. In: M. Müller-Wille (ed.): *Zwischen Tier und Kreuz. Untersuchungen zur wikingerzeitlichen Ornamentik im Ostseeraum*, pp. 9–203. Wachholtz. Neumünster.
– 2005: *Die gegossenen kleeblattförmigen Fibeln der Wikingerzeit aus Skandinavien*. Universitätsforschungen zur prähistorischen Archäologie, vol. 116. Habelt. Bonn.
Malcolm, G., D. Bowsher, R. Cowie 2003: *Middle-Saxon London. Excavations at the Royal Opera House 1989–99*. MoLAS Monograph, vol. 15. Museum of London Archaeological Service. London.
Mandt, G. 1988: Gudene til ære. Om miljøet rundt offerfunnene på Bergsøy i Sunnmørs-leia. In: S. Indrelid, S. Kaland, B. Solberg (eds.): *Festskrift til Anders Hagen*. Arkeologiske Skrifter, vol. 4, pp. 262–76. Historisk Museum. Bergen.
Mårtensson, L., E. Andersson, M.-L. Nosch, A. Batzer 2006a: *2005–2006*. Technical Report. Experimental Archaeology vol. 1. The Danish National Research Foundation's Centre

for Textile Research (CTR), University of Copenhagen.
– 2006b: *Flax*. Technical Report. Experimental Archaeology, vol. 2:1. The Danish National Research Foundation's Centre for Textile Research (CTR), University of Copenhagen.
– 2006c: *Whorl or bead?* Technical Report. Experimental Archaeology, vol. 2:2. The Danish National Research Foundation's Centre for Textile Research (CTR), University of Copenhagen.
Maul, B. 2002: *Frühmittelalterliche Gläser des 5.–7/8. Jahrhunderts n.Chr. Sturzbecher, glockenförmige Becher, Tummler und Glockentummler*. Universitätsforschungen zur prähistorischen Archäologie, vol. 84. Habelt. Bonn.
McCormick, M. 2001: *Origins of the European Economy. Communications and Commerce A.D. 300–900*. Cambridge University Press. Cambridge.
Mehling, A. 1998: *Archaika als Grabbeigaben. Studien an merowingerzeitlichen Gräberfeldern*. Tübinger Texte, vol. 1. Marie Leidorf. Rahden.
Menghin, W. 1973: Aufhängevorrichtung und Trageweise zweischneidiger Langschwerter aus germanischen Gräbern des 5. bis 7. Jahrhunderts. *Anzeiger des Germanischen Nationalmuseums*, 1973, pp. 7–56.
Middleton, N. 2005: Early medieval port customs, tolls and controls on foreign trade. *Early Medieval Europe*, vol. 13, pp. 313–58.
Milek, K.B., C.A.I. French 2007: Soils and Sediments in the Settlement and Harbour at Kaupang. In: D. Skre (ed.): *Kaupang in Skiringssal*. The Kaupang Excavation Project Publication Series, vol. 1, pp. 321–60. Aarhus Universty Press. Århus.
Miron, A., A.V.B. Miron 1997: Bernsteinsmück und -amulette aus einem keltischen Fürstinnengrab. In: M. Ganzelewski, R. Slotta (eds.): *Bernstein – Tränen der Götter*. Verlag Glückauf. Essen.
Mitchell, J. 1994: Fashion in Metal: A Set of Sword-belt Mounts and Bridle Furniture from San Vincenzo al Volturno. In: D. Buckton, T.A. Heslop (eds.): *Studies in Medieval Art an Architecture*, pp. 127–56. Sutton Pub Ltd. London.
Mitchell, J.G., H. Askvik, H.G. Resi 1984: Potassium-argon ages of schist honestones from the Viking Age sites at Kaupang (Norway), Aggersborg (Denmark), Hedeby (West Germany) and Wolin (Poland) and their archaeological implications. *Journal of Archaeological Science*, vol. 11, pp. 171–6.
Molaug, P.B. 1987: Leirkarmaterialet. In: E. Schia (ed.): *"Søndre Felt": Stratigrafi, bebyggelsesrester og daterende funngrupper*. De arkeologiske utgravningene i Gamlebyen, Oslo, vol. 3, pp. 229–328. Alvheim & Eide. Øvre Ervik.
– 1989: On the representativity of artefacts found during excavations in Norwegian medieval towns. In: S. Myrvoll (ed.): *Archaeology and the urban economy. Festschrift to Asbjørn E. Herteig*. Arkeologiske Skrifter, vol. 5, pp. 229–44. Historisk Museum. Bergen.
Moltesen, M. (ed.) 1997: *I Dianas hellige lund. Fund fra en helligdom i Nemi*. Ny Carlsberg Glyptotek. København.
Moore, D.T. 1978: The petrography of English honestones. *Journal of Archaeological Science*, vol. 5, pp. 61–73.
– 1983: Petrological aspects of some sharpening stones, touchstones, and milling stones. In: D.R.C. Kempe, A.P. Harvey (eds.): *The petrology of archaeological artefacts*, pp. 277–300. Clarendon Press. Oxford.
Moreland, J. 2000: Concepts of the Early Medieval Economy. In: I.L. Hansen, C. Wickham (eds.): *The Long eighth century. Production, Distribution and Demand*. The Transformation of the Roman World, vol. 11, pp. 1–34. Brill. Leiden.
– 2010: *Archaeology, Theory and the Middle Ages. Understanding the Early Medieval Past*. Duckworth. London.
Moreno-García, M., C. Orton, J. Rackham 1996: A new statistical tool for comparing animal bone assemblages. *Journal of Archaeological Science*, vol. 23, pp. 437–53.
Morris, C.D. 1998: Raiders, Traders and Settlers: the Early Viking Age in Scotland. In: H.B. Clarke, M. Ní Mhaonaigh, R. Ó Floinn (eds.): *Ireland and Scandinavia in the Early Viking Age*, pp. 73–103. Four Courts Press. Dublin.
Mortimer, C., M. Heyworth 2004: An early medieval glassworker's dump, The Brooks, Winchester. *Glass News*, vol. 15, p. 6.
Morton, A.D. (ed.) 1992: *Excavations 1946–83, excluding Six Dials and Melbourne Street*. Excavations at Hamwic, vol. 1. Council for British Archaeology Research report, vol. 84. London.
Motteau, J. 2005: Le verre à vitre dans la vallée de la Loire moyenne dans le haut moyen âge. *De Transparentes Spéculations. Vitres de l'Antiquité et du Haute Moyen Âge (Occident-Orient)*, vol. 4, pp. 98–101.
Müller, A. v. 1970: Karneolperlen aus Haithabu (Ausgrabung 1963–1964). In: K. Schietzel (ed.): *Das archäologische Fundmaterial*, vol. 1. Berichte über die Ausgrabungen in Haithabu, vol. 4, pp. 53–5. Wachholtz. Neumünster.
Muller, H. 1998: *Jet jewellery and ornaments*. Shire Album, vol. 52. Shire Publications Ltd. Buckinghamshire.
Müller-Wille, M. 1976: *Das Bootkammergrab von Haithabu*. Berichte über die ausgrabungen in

Haithabu, vol. 8. Wachholtz. Neumünster.
– 1977: Krieger und Reiter im Spiegel früh- und hochmittelalterlicher Funde Schleswig-Holsteins. *Offa*, vol. 34, pp. 40–74.
– 1985: Westeuropaisher Import der Wikingerzeit in Nordeuropa. In: S.O. Lindquist, B. Radhe (eds.): *Society and Trade in the Baltic during the Viking Age*. Acta Visbyensiana, vol. 7, pp. 79–102. Gotlands Fornsal. Visby.
– 1987: *Das wikingerzeitliche Gräberfeld von Thumby-Bienebek (Kr. Rendsburg-Eckernförde)*, vol. 2. Offa-Bücher, vol. 62. Wachholtz. Neumünster.
– 2001: Tierstile des 8.–12. Jahrhunderts im Norden Europas. Dendrochronologie und kunsthistorische Einordnung. In: M. Müller-Wille, L.O. Larsson (eds.): *Tiere, Menschen, Götter. Wikingerzeitliche Kunststile und ihre neuzeitliche Rezeption*, pp. 215–50. Vandenhoeck & Ruprecht. Göttingen.
Munch, G.S. 2003: Jet, amber, bronze, silver and gold artefacts. In: G.S. Munch, O.S. Johansen, E. Roesdahl (eds.): *Borg in Lofoten. A chieftain's farm in North Norway*, pp. 241–52. Tapir. Trondheim.
Munksgaard, E. 1970: To skattefund fra ældre vikingetid. Duesminde og Kærbyholm. *Aarbøger for Nordisk Oldkyndighed og Historie*, 1969, pp. 52–62.
– 1980: Justerede ringe af ædelmetal fra germansk jernalder og vikingetid. *Aarbøger for Nordisk Oldkyndighed og Historie*, 1978, pp. 150–3.
Munsell, A.H. 1929: *Munsell book of color. Defining, explaining, and illustrating the fundamental characteristics of color.* Munsell Color Co. Baltimore.
Musset, L. 2002: *La Tapisserie de Bayeux*. Nouvelle édition. Zodiaque, Paris.
Myhre, B. 1998: The archaeology of the Early Viking Age in Norway. In: H.B. Clarke, M. Ní Mhaonaigh, R. Ó Floinn (eds.): *Ireland and Scandinavia in the Early Viking Age*, pp. 3–36. Four Courts Press. Dublin.
– 2005: Produksjon av bergkrystallperler i Suldal- og Røldalsheiene i yngre jernalder. En perlehilsen til Lotte. *K.A.N.*, vol. 25, pp. 76–91.
Myrvoll, S. 1985: The trade in Eidsborg hones over Skien in the medieval period. In: T. Edgren (ed.): *Proceedings of the Third Nordic Conference on the Application of Scientific Methods in Archaeology*, vol. 5, pp. 31–49. Finska fornminnesföreningen. Helsinki.
– 1992: *Handelstorget i Skien. A study of activity on an early medieval site.* Nytt fra Utgravningskontoret i Bergen, vol. 2. Riksantikvaren. Bergen.
Näsman, U. 1979: Die Herstellung von Glasperlen. In: M. Bencard, K. Ambrosiani, L. Bender Jørgensen, H. Brinch Madsen, I. Nielsen, U. Näsman: Wikingerzietliches Handverk in Ribe. Eine Übersicht. *Acta Archaeologica*, vol. 49, pp. 113–38.
– 1984: *Glass och handel i senromersk tid och folkvandringstid. En studie kring glas från Eketorp-II, Öland, Sverige.* AUN, vol. 5. Uppsala.
– 1986: Vendel Period Glass from Eketorp-II, Öland, Sweden. *Acta Archaeologica,* vol. 56, pp. 55–116.
– 1990: Om fjärrhandel i Sydskandinaviens yngre järnålder. Handel med glas under germansk järnålder och vikingetid. *Hikuin*, vol. 16, pp. 89–118.
– 1991: Sea trade during the Scandinavian Iron Age: Its character, commodities, and routes. In: O. Crumlin-Pedersen (ed.): *Aspects of Maritime Scandinavia AD 200–1200*, pp. 23–40. The Viking Ship Museum. Roskilde.
– 2000: Exchange and Politics: the Eighth – early Ninth Century in Denmark. In: I.L. Hansen, C. Wickham (eds.): *The Long Eighth Century. Production, Distribution and Demand*. The Transformation of the Roman World, vol. 11, pp. 35–68. Brill. Leiden.
– 2003: Beads of amber, cornelian, glass, jet, rock-crystal and stone. In: G.S. Munch, O.S. Johansen, E. Roesdahl (eds.): *Borg in Lofoten. A chieftain's farm in North Norway*, pp. 232–40. Tapir. Trondheim.
Näsman, U., E. Roesdahl 2003: Scandinavian and European perspectives – Borg I:1. In: G.S. Munch, O.S. Johansen, E. Roesdahl (eds.): *Borg in Lofoten. A chieftain's farm in North Norway*, 283–99. Tapir. Trondheim.
Nerman, B. 1935: *Die Völkerwanderungszeit Gotlands*. KVHAA Monografier, vol. 21. Stockholm.
Neumann, G. 1964: Zwei frühgeschichtliche Funde aus Thüringen und ihre östlichen Parallelen. In: P. Grimm (ed.): *Varia Archaeologica. Festschrift für Wilhelm Unverzagt*. Deutsche Akademie der Wissenschaften, Schriften der Sektion für Vor- und Frühgeschichte, vol. 16, pp. 228–36. Berlin.
Newby, M. 1991: Glass from Farfa abbey: An interim report. *Journal of Glass Studies*, vol. 33, pp. 32–41.
Nicolaysen, N. 1886: Udgravninger i Kvelde (Hedrum) 1885. *Ab,* 1885, 22–43.
Norseng, P.G. 2000: Fra farmannen Ottar til hansakjøpmannen Bertram Bene. Synspunkter på kilde- og metodeproblematikken i studiet av handel. *Collegium Medievale*, vol. 13, pp. 11–77.
Nylén, E., B. Schönbäck 1994: *Tuna i Badelunda. Guld kvinnor och båtar,* vol. 1. Västerås kulturnämnds skriftserie, vol. 27. Västerås.
Ó Corráin, D. 1998: The Vikings in Scotland and Ireland in the Ninth Century. *Peritia*, vol. 12, pp. 296–339.
Ó Floinn, R. 1998: The Archaeology of the Early

Viking Age in Ireland. In: H.B. Clarke, M. Ní Mhaonaigh, R. Ó Floinn (eds.): *Ireland and Scandinavia in the Early Viking Age*, pp. 131–65. Four Courts Press. Dublin.
Økland, B.G. 1998: Det ureine avfallet. Unpublished Master thesis, University of Bergen.
Olcay, B.Y. 2001: Lighting methods in the Byzantine period and findings of glass lamps in Anatolia. *Journal of Glass Studies*, vol. 43, pp. 77–87.
Olsen, B. 1988: Interaction between Hunter-Gatherers and Farmers: Ethnographical and Archaeological Perspectives. *Archaeologia Polski*, vol. 33, pp. 425–33.
Olsen, O.M. 2004: Medieval fishing tackle from Bergen. In: I. Øye (ed.): *Medieval Fishing Tackle from Bergen and Borgund.* The Bryggen Papers Main Series, vol. 5, pp. 11–106. Fagbokforlaget. Bergen.
Opedal, A. 1998: *De glemte skipsgravene. Makt og myter på Avaldsnes.* AmS-småtrykk, vol. 47. Arkeologisk museum i Stavanger. Stavanger.
Ørsnes, M. 1966: *Form og stil i Sydskandinaviens yngre germanske jernalder.* Nationalmuseets skrifter, Arkæologisk-historisk række, vol. 11. København.
Orton, C. 1993: How many pots make five – an historical review of pottery quantification. *Archaeometry*, vol. 35, pp. 169–84.
Orton, C., P. Tyers, A. Vince 1993: *Pottery in archaeology.* Cambridge Manuals in Archaeology. Cambridge University Press. Cambridge.
Østerås, B. 2002: Slipesteinsberget i Sparbu. Kva undersøkingar av eit klebersteinsbrot kan fortelje om gamle steinhoggartradisjonar. Unpublished Master thesis, Vitenskapsmuseet, NTNU, Trondheim.
Østmo, E. 1984: Auve. Noen inntrykk fra en mellomneolittisk kystboplass i Vestfold. *Viking*, vol. 47, pp. 42–65.
– 1985: En dysse på Holtenes i Hurum. Nytt lys over østnorsk traktbegerkultur. *Viking*, vol. 48, pp. 70–82.
Øye, I. 1988: *Textile Equipment and its Working Environment, Bryggen in Bergen c 1150–1500.* The Bryggen Papers. Main Series, vol. 2. Norwegian University Press. Oslo.
– 2005: Kvinner, kjønn og samfunn fra vikingtid til reformasjonen, del 1. In: I. Blom og S. Sogner (eds): *Med kjønnsperspektiv på norsk historie*, pp. 21–101. Cappelen Akademisk forlag. Oslo.
– 2010: Women in early towns. In: J. Sheehan, D. Ó Corráin, P.F. Wallace (eds.): *The Viking Age. Ireland and the West*, pp. 298–308. Four Courts Press. Dublin.
Panter, I. 2000a: Jet and amber identification and provenancing. In: A.J. Mainman, N.S.H. Rogers (eds.): *Craft, industry and everyday life: Finds from Anglo-Scandinavian York.* The Archaeology of York. The small finds Fascicule 14, pp. 2470–4. York Archaeological Trust. London.
– 2000b: Amber working tools and techniques. In: A.J. Mainman, N.S.H. Rogers (eds.): *Craft, industry and everyday life: Finds from Anglo-Scandinavian York.* The Archaeology of York. The small finds, vol. 14, pp. 2501–17. York Archaeological Trust. London.
Paris, P. 1999: Une occupation du haut moyen age: Habitat et secteur artisanal dans la zone industrielle d'Allonn Oise. *Revue archéologique de Picardie*, vol. 1–2, pp. 183–201.
Parker, A.J. 1992: *Ancient Shipwrecks of the Mediterranean and the Roman Provinces.* BAR International Series, vol. 580. Oxford.
Paterson, C. 1999: Ennum ríblö unga. *Àrbók hins íslenzka fornleifafélags,* 1999, pp. 129–40.
– 2001: Insular Belt-fittings from the Pagen Norse Graves of Scotland: a Reappraisal in the Light of Scientific and Stylistic Analysis. In: M. Redknapp, N. Edwards, S. Youngs, A. Lane, J. Knight (eds.): *Pattern and Purpose in Insular Art*, pp. 125–32. Oxbow. Oxford.
– 2002: From Pendant to Brooches. The exchange of Borre and Jellinge style motifs across the North Sea. *Hikuin*, vol. 29, pp. 267–76.
Paulsen, P. 1956: *Axt und Kreuz in Nord- und Osteuropa*. Habelt. Bonn.
Paulsson, J. 1999: Metalldetektering och Uppåkra. Att förhålla sig till ett detektormaterial. In: B. Hårdh (ed.): *Fynden i Centrum. Keramik, glas och metall.* Uppåkrastudier, vol. 2. Acta archaeologica Lundensia, Series in 8°, vol. 30, pp. 41–58. Almqvist & Wiksell. Stockholm.
Pedersen, A. 1997: Weapons and riding gear in burials – evidence of military and social rank in 10th century Denmark? In: A.N. Jørgensen, B.L. Clausen (eds.): *Military Aspects of Scandinavian Society in a European Perspective, AD 1–1300.* Publications from the National Museum, Studies in archaeology & history, vol. 2, pp. 123–35. København.
– 2005: The Metal Detector and the Viking Age in Denmark. In: A. Mortensen, S.V. Arge (eds.): *Viking and Norse in the North Atlantic*, pp. 402–11. Føroya Froðskaparfelag. Tórshavn.
Pedersen, U. 2008: Weights and Balances. In: D. Skre (ed.): *Means of exchange.* Kaupang Excavation Project Publication Series, vol. 2, pp. 119–95. Aarhus University Press. Århus.
– in prep.: In the Melting Pot. Metalworkers in action at Early Viking Age Kaupang. Kaupang Excavation Project Publication Series, vol. 4. Aarhus University Press. Århus.
Pedersen, U., L. Pilø 2007: The Settlement: Artefacts and Site Periods. In: D. Skre (ed.): *Kaupang in Skiringssal.* Kaupang Excavation Project Publication Series, vol. 1, pp. 179–90. Aarhus

University Press. Århus.
Périn, P. 1989: Le verre mérovingien. In: D. Foy, G. Sennequier (eds.): *À travers le verre du moyen âge à la renaissance*, pp. 125–31. Exhibition catalogue from Musée des Antiquities de Seine-Maritime. Rouen.
– 1996: Die archäologischen Zeugnisse der fränkischen Expansion in Gallien. In: K. von Welck, A. Wieczorek, H. Ament (eds.): *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 227–32. Philipp von Zabern. Mainz.
Périn, P., L.-C. Feffer (eds.) 1985: *La Neustrie. Les pays au nord de la Loire de Dagobert à Charles le Chauve VIIe-IXe siècles*. Musées et monuments departementaux de Seine-Maritime. Rouen.
Petersen, J. 1914: Bretspillet i Norge i Forhistorisk Tid. *Oldtiden,* vol. 4, pp. 75–92.
– 1919: *De norske vikingesverd. En typologisk-kronologisk studie over vikingetidens vaaben*. Videnskabsselskapet. II. Hist.-fil. kl., Skrifter 1919:1. Kristiania.
– 1928: *Vikingetidens smykker*. Stavanger museums skrifter, vol. 2. Stavanger.
– 1951: *Vikingetidens redskaper*. Det Norske Videnskaps-Akademi. II. Hist.-fil. kl., Skrifter 1951:4. Oslo.
Pettersen, G.I. 2000: Handel og priser i Norge i middelalderen. *Collegium Medievale*, vol. 13, pp. 203–28.
Picon, M., M. Vichy 2003: D'Orient en Occident: l'origine du verre à l'époque romain et durant le haut Moyen Âge. In: D. Foy, M.-D. Nenna (eds.): *Échanges et commerce du verre dans le monde antique*. Monographies instrumentum, vol. 24, pp. 17–31. Editions Monique Mergoil. Montagnac.
Pieta, K., A. Ruttkay, M. Ruttkay 2006 (eds.): *Bojná. Hospodárske a politické centrum Nitrianskeho kniežatstva – Wirtschaftliches und politisches Zentrum der Fürstentums von Nitra*. Archaeologica Slovaca Monographiae, vol. 9. Archeologický ústav SAV. Nitra.
Pilø, L. 1990: Early soapstone vessels in Norway from the Late Bronze Age to the Early Roman Iron Age. *Acta Archaeologica,* vol. 60, pp. 87–100.
– 2007a: Evidence from the Settlement Area 1956–1984. In: D. Skre (ed.): *Kaupang in Skiringssal*. The Kaupang Excavation Project Publication Series, vol. 1, pp. 129–39. Aarhus University Press. Århus.
– 2007b: The Fieldwork 1998–2003. Overview and Method. In: D. Skre (ed.): *Kaupang in Skiringssal*. The Kaupang Excavation Project Publication Series, vol. 1, pp. 143–60. Aarhus University Press. Århus.
– 2007c: The Settlement: Extent and Dating. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 161–78. Aarhus University Press. Århus.
– 2007d: The Settlement: Character, Structures and Features. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 191–222. Aarhus University Press. Århus.
Pilø, L., I. Baug, S. Kristensen, U. Pedersen, L. Tarrou 2003: Innberetning fra hovedundersøkelsen Søndre Kaupang, Gnr. 1012, Bnr 9 og 10, Larvik kommune, Vestfold 2000–2002. Unpublished report, KHM archive.
Pilø, L., U. Pedersen, K. Stene, V. Tørhaug 2000: Innberetning fra undersøkelse av traséer for sykkel-/gangvei og avløp i bosetningsområdet på Kaupang, gnr. 1010/1029, Larvik kommune, Vestfold. Unpublished report, KHM Archive.
Pöche, A. 2005: *Perlen, Trichtergläser, Tesserae: Spuren des Glashandels und Glashandwerks auf dem frühgeschichtlichen Handelsplatz von Groß Strömkendorf, Landkreis Nordwestmecklenburg*. Forschungen zu Groß Strömkendorf, vol. 2. Beiträge zur Ur- und Frühgeschichte Mecklenburg-Vorpommerns, vol. 44. Archäologisches Landesmuseum Mecklenburg-Vorpommerns, Schwerin.
Pollard, A.M., G.D. Bussell, D.C. Baird 1981: The analytical investigation of early Bronze Age jet and jet-like material from the Devizes Museum. *Archaeometry*, vol. 23:2, pp. 139–67.
Qviller, B. 1996: *Rusens historie*. Det norske samlaget. Oslo.
Rabben, A. 2002: Med vevsverd og steikepanne. Tekstilredskaper og kjøkkenredskaper i vestnorske mannsgraver fra yngre jernalder. Unpublished Master thesis, University of Bergen.
Rademacher, F. 1942: Fränkishe Gläser aus dem Rheinland. *Bonner Jahrbücher*, vol. 147, pp. 287–344.
– 1963 [1933]: *Die deutschen Gläser des Mittelalters*. Reprinted 2nd edition. Berlin.
Ramskou, T. 1950: Viking Age Cremation Graves in Denmark. A survey. *Acta Archaeologica*, vol. 21, pp. 137–82.
Ramstad, M. 2006: Perler og mennesker 4000 f.Kr. Om miljøet rundt ravfunnene fra Finnmarks steinalder. In: R. Barndon (ed.): *Samfunn, symboler og identitet. Festskrift til Gro Mandt på 70-årsdagen*. UBAS, vol. 3, pp. 129–46. AHKR, Universitetet i Bergen. Bergen.
Randsborg, K. 1980: *The Viking-period in Denmark. The formation of a state*. Duckworth. London.
Rau, R. 1955: *Die Reichsannalen. Einhard Leben Karls des Grossen. Zwei "Leben" Ludwigs. Nithard Geschichten*. Quellen zur karolingischen Reichsgeschichte, vol 1. Wissenschaftliche Buchgesellschaft. Darmstadt.
– 1992: *Jahrbücher von Fulda, Regino Chronik,*

Notker Taten Karls. Quellen zur karolingischen Reichsgeschichte, vol. 3. Wissenschaftliche Buchgesellschaft. Darmstadt.

Redknap, M. 1999: Die römischen und mittelalterlichen Töpfereien in Mayen, Kreis Mayen-Koblenz. *Berichte zur Archäologie an Mittelrhein und Mosel,* vol. 6, pp. 11–401. Rheinisches Landesmuseum, Trier.

Resi, H.G. 1979: *Specksteinfunde aus Haithabu*. Berichte über die Ausgrabungnen in Haithabu, vol. 14. Wachholtz. Neumünster.

– 1981: Specksteinobjekte und Schieferwetzsteine aus Haithabu als Beispiele skandinavischer Massenhandelsgüter der Wikingerzeit. Unpublished Doctoral thesis, University of Bergen.

– 1987a: Reflections on Viking Period Local Trade in Stone Products. In: J.E. Knirk (ed.): *Proceedings of the Tenth Viking Congress, Larkollen, Norway, 1985.* Universitetets Oldsaksamlings Skrifter, Ny rekke, vol. 9, pp. 95–102. Oslo.

– 1987b: Perlene. In: T. Hjørungdal, R.W. Lie, E. Schjølberg, H.G. Resi: En båtgrav fra Røsvik på Sunnmøre. *Viking,* vol. 50, pp. 131–9.

– 1990: *Die Wetz- und Schleifsteine aus Haithabu*. Berichte über die Ausgrabungen in Haithabu, vol. 28. Wachholtz. Neumünster.

– 2000: Kaupang, før nye utgravninger. *Collegium Medievale*, vol. 13, pp. 141–64.

– 2005: Archaeological Finds of Jet from Norway: Signs of continuous contact westwards in the Viking and Medieval Periods? *Collegium Medievale*, vol. 18, pp. 86–105.

– 2007: En fingerring av jet. In: B. Weber, I. Martens, E. Østmo: *Vesle Hjerkinn. Kongens gård og sælehus.* Norske oldfunn, vol. 21, pp. 118–20. UKM. Oslo.

– 2008: Whetstones and grindstones used in everyday life at Kaupang. In: H. Askvik , H.G. Resi: *Whetstones and grindstones in the settlement area. The 1956–1974 excavations.* Kaupang-funnene, vol. 3:C. Norske oldfunn, vol. 29, pp. 19–149. KHM. Oslo.

Resi, H.G., H. Askvik 2008: *Whetstones and grindstones in the settlement area. The 1956–1974 excavations.* Kaupang-funnene, vol. 3:C. Norske oldfunn, vol. 29. KHM. Oslo.

'Rígsþula': *Gudedigte.* Eddadigte, vol. 2. Udgivet af Jón Helgason. 2nd edition. Nordisk filologi. A. Tekster, pp. 72–9. Dreyer. Oslo 1971.

Ringrose, T.J. 1993: Bone counts and statisitics – a critique. *Journal of Archaeological Science*, vol. 20, pp. 121–57.

Risbøl, O. 1994: Socialøkonomiske aspekter ved vikingetidens klæberstenshandel i Sydskandinavien. *Lag*, vol. 5, pp. 115– 61.

Rispling, G., M. Blackburn, K. Jonsson 2008: Catalogue of the Coins. In: D. Skre (ed.): *Means of Exchange.* Kaupang Excavation Project Publication Series, vol. 2, pp. 75–93. Aarhus University Press. Århus.

Roaldset, E. 1972: Mineralogy and geochemistry of Quaternary clays in the Numedal area, southern Norway. *Norsk Geologisk Tidsskrift*, vol. 52, pp. 335–69.

Roes, A. 1954: Agrafes du haute moyen âge à double crochet. *Revue Archéologique de l'Est et Centre-Est,* vol. 5, pp. 330–4.

– 1963: *Bone and antler objects from the Frisian terp-mounds.* Tjeenk Willink & Zoon. Haarlem.

– 1965: *Vondsten van Dorestad*. Archaeologica Traiectina, vol. 7. Groningen.

Roesdahl, E. 1977: *Oldsagerne og gravpladsen.* Fyrkat. En jysk vikingeborg, vol. 2. Nordiske Fortidsminder, Serie B, vol. 4. København.

– 1980: *Danmarks vikingetid.* Gyldendal. København.

– 1981: Aggersborg in the Viking Age. In: H. Bekker Nielsen, P. Foot, O. Olsen (eds.): *Proceedings of the Eighth Viking Congress.* Medieval Scandinavia, Suppl., vol. 2, pp. 107–22. Odense University Press. Odense.

Roesdahl, E., J. Graham-Campbell, P. Connor, K. Pearson (eds.) 1981: *The Vikings in England and in their Danish homeland*. The Anglo-Danish Viking Project. London.

Roslund, M. 1997: På drift i tid och rum? Om informationspotentialen i komposita dokumentationsmaterial. *Meta*, vol. 3, pp. 37–53.

– 2001: *Gäster i huset. Kkulturell överföring mellan slaver och skandinaver 900 till 1300.* Skrifter utgivna av Vetenskapssocieteten i Lund, vol. 92. Lund.

– 2007: *Guests in the House. Cultural Transmission between Slavs and Scandinavians 900 to 1300 A.D.* The Northern World, vol 33. Brill. Leiden.

Roth, H. 1986: *Kunst und Handwerk im frühen Mittelalter. Archäologische Zeugnisse von Childerich I. bis zu Karl dem Großen*. Theiss. Stuttgart.

Rottländer, R.C.A. 1975: Der Bernstein und seine Bedeutung in der Ur- und Frühgeschichte. *Acta Praehistorica et Archaeologica,* vol. 4 1973, pp. 11–32.

Rui, L.M. 1991: Kljåsteiner – vevlodd, In: E. Schia, P.B. Molaug (eds.): *Dagliglivets gjenstander,* vol. 2. De arkeologiske utgravninger i Gamlebyen, Oslo, vol. 8, pp. 113–30. Alvheim & Eide. Øvre Ervik.

Rygh, K. 1871: *Katalog over det Kgl. Norske Videnskabernes Selskabs Oldsamling.* Det Kongelige norske videnskabers selskab, Museet. Trondheim.

Rygh, O. 1885: *Norske oldsager ordnede og forklarede*. Cammermeyer. Christiania.

Sablerolles, Y. 1999: The glass vessel finds. In: J.C. Besteman, J.M. Bos, D.A. Gerrets, H.A. Heidinga, J. de Koning (eds.): *The Excavations at Wijnaldum*. Reports on Frisia in Roman and Medieval times, vol. 1, pp. 229–52. A.A. Balkema. Rotterdam.

Sablerolles, Y., J. Henderson, W. Dijkman 1997: Early-medieval glass beadmaking in Maastricht (Jodenstraat 30), The Netherlands. An archaeological and scientific investigation. In: U. von Freeden, A. Wieczorek (eds.): *Perlen. Archäologie, Techniken, Analysen*, pp. 293–313. Habelt. Bonn.

Salmo, H. 1956: Finnische Hufeisenfibeln. *Finska Fornminnesföreningens Tidskrift*, vol. 56, pp. 1–106.

Sande, S. 1998: Løse legemsdeler 1. *Klassisk forum*, vol. 2, pp. 8–19.

Sanderson, D.C.W., J.R. Hunter, S.E. Warren 1984: Energy Dispersive X-ray Flourescence Analysis of 1st Millennium AD Glass from Britain. *Journal of Archaeological Science*, vol. 11, pp. 53–69.

Sanderson, D.C.W., J.B. Hutchings 1987: The origins and measurement of colour in archaeological glasses. *Glass Technology*, vol. 28, pp. 99–105.

Sanke, M. 1999: "Wikingerschutt" aus Deventer und Zutphen. Zwei enddatierte Keramikkomplexe mit rheinischer Importware aud den Niederlanden. In: S. Brather, C. Büscker, M. Hoeper (eds.): *Archäologie als Sozialgeschichte. Studien zu Siedlung, Wirtschaft und Gesellschaft im frühgeschichtlichen Mitteleuropa. Festschrift für Heiko Steuer zum 60.Geburtstag*, pp. 251–67. Marie Leidorf. Rahden.

– 2001: VII. Gelbe Irdenware. In: H. Lüdtke, K. Schietzel: *Handbuch zur mittelalterlichen Keramik in Nordeuropa*, vol. 1:Text, pp. 271–428. Wachholz. Neumünster.

Sanke, M., K.H. Wedepohl, A. Kronz 2002: Karolingerzeitliches Glas aus dem Kloster Lorch. *Zeitschrift für Archäologie des Mittelalters*, vol. 30, pp. 37–75.

Sayre, E.V., R.W. Smith 1961: Compositional Categories of Ancient Glass. *Science*, vol. 133, pp. 1824–6.

Ščapova , J.L. 1992: Un lissoire de Novgorod. *Acta Archaeologica*, vol. 62, pp. 231–43.

Schach-Dörges, H. 1997: "Zusammengespülte und vermengte Menschen". Suebische Kriegerbünde werden sesshaft. In: K. Fuchs, M. Kempa, R. Redies (eds.): *Die Alamannen*, pp. 79–102. Theiss. Stuttgart.

Schia, E., C. Wiberg 1979: Andre gjenstander. In: E. Schia (ed.): *Feltene "Oslogate 3 og 7" Bebyggelsesrester og funngrupper.* De arkeologiske utgravningene i Gamlebyen, Oslo, vol. 2, pp. 105–7. Alvheim & Eide. Øvre Ervik.

Schietzel, K. 1981: *Stand der siedlungsarchäologischen Forschung in Haithabu – Ergebnisse und Probleme*. Berichte über die Ausgrabungen in Haithabu, vol. 16. Wachholtz. Neumünster.

Schiffer, M.B. 1987: *Formation Processes of the Archaeological Record*. University of New Mexico Press. Albuquerque.

Schlosser, I. 1977: *Das Alte Glas. Ein Handbuch für Sammler und Liebhaber.* 3rd edition. Bibliothek für Kunst- und Antiquitäten-Freunde, vol. 36. Braunschweig.

Schmid, P., G. Neumann, B. Sjölin, R.H. Bremmer, U. Timmermann, L.-E. Ahlsson, K. Düwel, H.F. Nielsen, E. Taayke, E. Knol, H.J. Kühn, D. Strauch, K. Schäferdiek 1998: Friesen. *RGA*, vol. 10, pp. 2–69.

Schmidt, B 1961: *Die späte Völkerwanderungszeit in Mitteldeutschland*. Veröffentlichungen des Landesmuseums für Vorgeschichte in Halle, vol. 18. Halle.

– 1976: *Die späte Völkerwanderungszeit in Mitteldeutschland. Katalog (Nord- und Ostteil)*. Veröffentlichungen des Landesmuseums für Vorgeschichte in Halle, vol. 29. Halle.

Scholz, B.W. 1972: *Royal Frankish annals and Nithard's Histories*. University of Michigan Press. Ann Arbor.

Schou, T.P. 2007: Handel, produksjon og kommunikasjon – en undersøkelse av klebersteinsvirksomheten i Aust-Agders vikingtid med fokus på Fjære og Landvik. Unpublished Master thesis, University of Bergen.

Schuldt, E. 1956: *Die Slawische Keramik in Mecklenburg.* Deutsche Akademie der Wissenschaften zu Berlin. Schriften der Sektion für Vor- und Frühgeschichte, vol. 5. Akademie Verlag. Berlin.

Schultze, J. 2005: Zur Frage der Entwiklung des zentralen Siedlungskernes von Haithabu. In: C. Dobiat (ed.): *Reliquiae gentium. Studies in honour of Wolfgang Böhme on the occasion of his 65th birthday*, vol. 1, pp. 359–73. M. Leidorf. Rahden.

Schulze-Dörrlamm, M. 1993: Bestattungen in den Kirchen Großmährens und Böhmens während des 9. und 10. Jahrhunderts. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, vol. 40, pp. 557–620.

– 1998: Das karolingische Kreuz von Baume-les-messieures, Dép. Jura, mit Tierornamenten im frühen Tassilokelchstil. *Archäologisches Korrespondenzblatt*, vol. 28, pp. 131–50.

– 1999: Münzfibeln der Karolingerzeit. *Archäologisches Korrespondenzblatt*, vol. 29, pp. 271–88.

Schwarz-Mackensen, G. 1976: *Die Knochennadeln von Haithabu*. Berichte über die Ausgrabungen in Haithabu, vol. 9. Wachholtz. Neumünster.

Selling, D. 1955: *Wikingerzeitliche und frühmit-*

telalterliche Keramik in Schweden. Pettersons Bokindustri. Stockholm.
Serçe Limani Shipwreck Excavation web-site. Available on the World Wide Web at http://ina.tamu.edu/SerceLimani.htm. Site visited 2006.
Sheehan, J. 1998: Early Viking Age Silver Hoards from Ireland and their Scandinavian Elements. In: H.B. Clarke, M. Ní Mhaonaigh, R. Ó Floinn (eds.): *Ireland and Scandinavia in the Early Viking Age*, pp. 166–202. Four Courts Press. Dublin.
– 2001: Ireland´s Viking Age Hoards. Sources and Contacts. *The Vikings in Ireland*, pp. 51–9. The Viking Ship Museum. Roskilde.
– 2008: The Longphort in Viking Age Ireland. *Acta Archaeologica*, vol. 79, pp. 282–95.
Sheridan, A., M. Davis 2002: Investigating jet and jet-like artifacts from prehistoric Scotland: the National Museums of Scotland project. *Antiquity*, vol. 76, pp. 812–25.
Shetelig, H. 1912: Kar av kleberstein fra jernalderen. In: A.W. Brøgger (ed.): *Oldtiden, tidsskrift for Norsk forhistorie,* pp. 49–73. A.W. Brøggers boktrykkeri. Stavanger.
– 1912b: *Vestlandske graver fra jernalderen*. Bergen museums skrifter, ny række, vol. 2:1. Bergen.
– 1922: *Primitive Tider i Norge*. Grieg. Bergen.
– 1946: Smykker av jet i norske vikingefunn. *Bergens Museums Årbok,* 1944, pp. 1–14.
Shindo, Y. 2009: Islamic glass excavated in Egypt: Fustat, Raya, and al-Tur al-Kilani. *Annales of the 17th Congress of the AIHV*, pp. 308–13. Aspeditions. Antwerpen.
Siegmund, F. 1998: *Merovingerzeit am Niederrhein. Die frühmittelalterlichen Funde aus dem Regierungsbezirk Düsseldof und dem Kreis Heinsberg*. Rheinische Ausgrabungen, vol. 34. Rheinland-Verlag. Köln.
Silvestri, A., G. Molin, G. Salviulo 2005: Roman and Mediaval Glass from the Italian Area: Bulk Characterization and Relationships with Production Technologies. *Archaeometry*, vol. 47, pp. 797–816.
Sindbæk, S.M. 2005: *Ruter og rutinisering. Vikingetidens fjernhandel i Nordeuropa*. Multivers. København.
– 2007: Networks and nodal points. The emergence of towns in early Viking Age Scandinavia. *Antiquity*, vol. 81, pp. 119–32.
Sjøvold, T. 1974: *The Iron Age Settlement of Arctic Norway*, vol. 2. Tromsø Museums Skrifter, vol. 10:2. Norwegian Universities Press. Oslo.
Skaare, K. 1976: Øre, *KLNM*, vol. 20, pp. 716–18.
Skibsted Klæsø, I. 1995: Det trefligede beslag fra Trabjerg Bakker og andre detektorfund. In: L. Bender Jørgensen, P. Eriksen (eds.): *Trabjerg. En vestjysk landsby fra vikingetiden*. Jysk Arkæologisk Selskabs skrifter, vol. 31:1, pp. 107–11. Aarhus.
– 1999: Vikingetidens kronologi – en nybearbejdelse af det arkæologiske materiale. *Aarbøger for Nordisk Oldkyndighed og Historie,* 1997, pp. 89–142.
– 2001: Trefligede spænder fra Uppåkra. In: B. Hårdh (ed.): *Uppåkra. Centrum och sammanhang.* Uppåkrastudier, vol. 3. Acta archaeologica Lundensia, Series in 8°, vol. 34, pp. 217–38. Almqvist & Wiksell. Stockholm.
Skjølsvold, A. 1961: *Klebersteinsindustrien i vikingetiden*. Universitetsforlaget. Oslo.
Skovmand, R. 1942: De danske skattefund. *Aarbøger for Nordisk Oldkyndighed og Historie*, 1942, pp. 1–275.
Skre, D. 2000: Kaupang – et handelssted? *Collegium Medievale*, vol. 13, pp. 165–76.
– (ed.) 2007a: *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1. Aarhus University Press. Århus.
– 2007b: Introduction. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 13–24. Aarhus University Press. Århus.
– 2007c: Exploring Skiringssal 1771–1999. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 27–42. Aarhus University Press. Århus.
– 2007d: Preparing the New Campaign. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 43–51. Aarhus University Press. Århus.
– 2007e: Excavations of the Hall at Huseby. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 223–47. Aarhus University Press. Århus.
– 2007f: The Skiringssal Cemetery. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 363–83. Aarhus University Press. Århus.
– 2007g: The Skiringssal Thing Site Þjóðalyng. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 385–406. Aarhus University Press. Århus.
– 2007h: The Dating of Ynglingatal. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 407–29. Aarhus University Press. Århus.
– 2007i: The Emergence of a Central Place: Skiringssal in the 8th Century. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 431–43. Aarhus University Press. Århus.
– 2007j: Towns and Markets, Kings and Central Places in South-western Scandinavia c. AD 800–950. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 445–69. Aarhus University Press. Århus.

– (ed.) 2008a: *Means of Exchange*. Kaupang Excavation Project Publication Series, vol. 2. Aarhus University Press. Århus.
– 2008b: Introduction. In: D. Skre (ed.): *Means of Exchange*. Kaupang Excavation Project Publication Series, vol. 2, pp. 9–11. Aarhus University Press. Århus.
– 2008c: Post-Substantivist Towns and Trade AD 600–1000. In: D. Skre (ed.): *Means of Exchange*. Kaupang Excavation Project Publication Series, vol. 2, pp. 327–41. Aarhus University Press. Århus.
– 2008d: Dealing with Silver. Economic Agency in South-Western Scandinavia AD 600–1000. In: D. Skre (ed.): *Means of Exchange*. Kaupang Excavation Project Publication Series, vol. 2, pp. 343–55. Aarhus University Press. Århus.
– 2008e: Dark Age Towns: The Kaupang Case. Reply to Przemysław Urbańczyk. *Norwegain Archaeological Review*, vol. 41, pp. 194–212.
– in press: Commodity money, silver and coinage in Viking Age Scandinavia. In: S.M. Sindbæk, J. Graham-Campbell, G. Williams (eds.): *Silver Economies, Monetisation and Society in Scandinavia 800–1100*. Aarhus University Press. Århus.
Skre, D., F.-A. Stylegar. 2004: *Kaupang: the Viking Town. The Kaupang Exhibition at UKM, Oslo, 2004–2005*. UKM. Oslo.
Sode, T. 1996: *Anatolske glasperler*. Thot. København.
– 2002: Glasskår fra markedspladsen i Ribe – handel med råglas og glasskår. In: J. Pind, A.N. Jørgensen, L. Jørgensen, B. Storgård, P.O. Rindel, J. Ilkjær (eds.): *Drik – og du vil leve skønt. Festkrift til Ulla Lund Hansen på 60-årsdagen 18. august 2002*. Publications from The National Museum Studies in Archaeology and History, vol. 7, pp. 113–21. København.
– 2004: Glass Beadmaking Technology. In. Bencard, M., A. Kann Rasmussen, H. Brinch Madsen (eds.): *Ribe Excavations 1970–76*, vol. 5. Jutland archaeological Society Publications, vol. 46, pp. 83–102. Højbjerg.
Sode, T., C. Feveile 2002: Segmenterede metalfolierede glasperler og blæste hule glasperler med metalbelægning fra markedspladsen i Ribe. *By, marsk og geest*, vol. 14, pp. 5–14.
Söderlind, M. 2002: *Late Etruscan Votive Heads from Tessennano. Production, Distribution, Sociohistorical Context.* Studia Archaeologica, vol. 118. L'Erma di Bretschneider. Roma.
Solberg, B. 2007: Pasttimes or serious business? Norwegian graves with gaming objects c. 200–1000 AD. In: B. Hårdh, K. Lennbert, D. Olausson (eds.): *On the road.* Acta archaeologica Lundensia, Series in 4°, vol. 26, pp. 265–9. Almqvist & Wiksell. Stockholm.
Šolle, M. 1966: *Stará Kouřim a projevy velkomoravské hmotné kultury v Cechách. Alt Kourim und die Äusserungen der Grossmährischen Kultur in Böhmen*. Monumenta Archaeologica, vol. 15. Praha.
Solli, B. 2002: *Seid. Myter, sjamanisme og kjønn i vikingenes tid.* Pax. Oslo.
Sørensen, A.C. 2001: *Ladby. A Danish Ship-Grave from the Viking Age*. Ships and Boats of the North, vol. 3. The Viking Ship Museum. Roskilde.
Sørensen, R., K.E. Henningsmoen, H.I. Høeg, B. Stabell, K.M. Bukholm 2007: Geology, Soils, Vegetation and Sea-levels in the Kaupang Area. In: D. Skre (ed.): *Kaupang in Skiringssal*. Kaupang Excavation Project Publication Series, vol. 1, pp. 251–72. Aarhus University Press. Aarhus.
Sørensen, S.A. 2000: *Hørup – en sjællandsk værkstedsplads fra romersk jernalder*. Museet Færgegaarden. Jægerspris.
Sørheim, H. 1997: The origin of commercial fisheries and the trade of stockfish in the northern part of Western Norway. In: G. De Boe, F. Verhaeghe (eds.): *Exchange and Trade in Medieval Europe,* vol. 3. Institute for the Archaeological Heritage. Zellik.
– 2004: Borgund and the Borgundfjord fisheries. In: I. Øye (ed.): *Medieval fishing tackle from Bergen and Borgund.* The Bryggen Papers. Main Series No. 5, pp. 107–33. Fagbokforlaget. Bergen.
Spall, C. 2003: Evidence for Craft-working from Sector 1, 2001–2. *Tarbat Discovery Programme, Bulletin*, vol. 7, 2001–2. Available through the World Wide Web at http://www.york.ac.uk/depts/arch/staff/sites/tarbat/bulletins/bulletin7/research.html Site Visited 01.03.2007.
Spiong, S. 2000: *Fibeln und Gewandnadeln des 8.–12. Jahrhunderts in Zentraleuropa. Eine archäologische Betrachtung ausgewählter Kleidungsbestandteile als Indikatoren menschlicher Identität*. Zeitschrift für Archäologie des Mittelalters, Beiheft 12. Habelt. Bonn.
Steinhausen, J. 1939: Frühmittelalterliche Glashütten im Trierer Land. *Trier Zeitschrift für Geschicte und Kunst des Trierer Landes und seiner Nachbargebiete*, vol. 14, pp. 29–57.
Stemshaug, O., J. Sandnes, K. Aune 1976: *Norsk stadnamnleksikon*. Samlaget. Oslo.
Stenberger, M. 1958: *Die Schatzfunde Gotlands der Wikingerzeit*, vol. 1:Text. KVHAA Stockholm.
Stenvik, L.F. 2001: *Skei – et maktsenter fram fra skyggen*. Vitark, vol. 2. Vitenskapsmuseet, NTNU. Trondheim.
Steppuhn, P. 1998: *Die Glasfunde von Haithabu*. Berichte über die Ausgrabungen in Haithabu, vol. 32. Wachholtz. Neumünster.
– 1999: Der mittelalterliche Gniedelstein:

Glättglas oder Glasbarren? Zu Primärfunktion und Kontinuität eines Glasobjektes vom Frühmittelalter bis zur Neuzeit. *Nachrichten aus Niedersachsens Urgeschichte*, vol. 68, pp. 113–39. Theiss. Stuttgart.

– 2001: Kordel. *RGA*, vol. 17, pp. 250–2.

– 2006: Beads of glass and stone. In: S. H. Fuglesang and D. M. Wilson (eds.): *The Hoen hoard. A Viking gold treasure of the ninth century.* Norske oldfunn, vol. 20, pp. 203-220. KHM. Oslo.

Steuer, H. 1974: *Die Südsiedlung von Haithabu. Studien zur frühmittelalterlichen Keramik im Nordseeküstenbereich und in Schleswig-Holstein.* Die Ausgrabungen in Haithabu vol. 6. Wachholtz. Neumünster.

– 1979: Die Keramik aus der frühgeschichtlichen Wurt Elisenhof. *Elisenhof. Die Ergebnisse der Ausgrabung der frühgeschichtlichen Marschensiedlung beim Elisenhof in Eiderstedt 1957/58 und 1961/64.* Studien zur Küstenarchaeologie Schleswig-Holsteins. Serie A, pp. 3–147. P. Lang. Frankfurt am Main.

– 1999: Handel und Wirtschaft in der Karolingerzeit. In: C. Stiegemann, M. Wemhoff (eds.): *799: Kunst und Kultur der Karolingerzeit. Beiträge zum Katalog der Ausstellung, Paderborn 1999. Karl der Große und Papst Leo III. in Paderborn*, vol. 3. Philipp von Zabern. Mainz.

Steuer, H., H. Beck, B. Bulitta, D.M. Wilson, K. Düwel 1999: Handel. *RGA*, vol. 13, pp. 497–593.

Steuer, H., W.B. Stern, G. Goldenberg 2002: Der Wechsel von der Münzgeld- zur Gewichtsgeldwirtschaft in Haithabu um 900 und die Herkunft des Münzsilbers im 9. und 10. Jahrhundert. In: K. Brandt, M. Müller-Wille, C. Radtke (eds.): *Haithabu und die frühe Stadtentwicklung im nördlichen Europa*. Schriften des archäologischen Landesmuseums, vol. 8, pp. 133–67. Wachholtz. Neumünster.

Stevenson, J. 2001: The Vessel Glass. In: J. Mitchell, I.L. Hansen, C.M. Coutts (eds.): *The Finds from the 1980–86 Excavations*. San Vincenzo al Volturno, vol. 3, pp. 203–77. Centro Italiano di Studio Sull'alto Medievo. Spoleto.

Stiaffini, D. 1993: The presence of glass in funerary contexts in Italy (4th–7th century). *Annales du 12e congrès de l'Association Internationale pour l'Histoire du Verre*, pp. 177–85. Amsterdam.

Stiegemann, C., M. Wemhoff (eds.) 1999: *799: Kunst und Kultur der Karolingerzeit. Katalog der Ausstellung, Paderborn 1999. Karl der Große und Papst Leo III in Paderborn*, vols. 1–3. Philipp von Zabern. Mainz.

Stiff, M. 1996: "Through a glass darkly": Seventh to ninth century vessel glass from 'wics' and 'emporia' in North western Europe. Unpublished PhD thesis, University of Oxford. The British Library Document Supply Centre. Boston Spa.

– 2001: Typology and Trade: a Study of the Vessel Glass from Wics and Emporia in Northwest Europe. In: D. Hill, R. Cowie (eds.): *Wics. The Early Mediaeval Trading Centres of Northern Europe*. Sheffield Archaeological Monographs 14, pp. 44–9. Sheffield Academic Press.

– 2003: The Glass Finds. In: G. Malcolm, D. Bowsher, R. Cowie: *Middle-Saxon London. Excavations at the Royal Opera House 1989–99*. MoLAS Monograph, vol. 15, pp. 141–50. Museum of London Archaeological Service. London.

Stilke, H. 2001a: IV. Muschelgrusware. In: H. Lüdtke, K. Schietzel: *Handbuch zur mittelalterlichen Keramik in Nordeuropa*, vol. 1:Text, pp. 175–208. Wachholz. Neumünster.

– 2001b: VI. Tatinger ware. In: H. Lüdtke, K. Schietzel: *Handbuch zur mittelalterlichen Keramik in Nordeuropa*, vol. 1:Text, pp. 257–70. Wachholz. Neumünster.

Stjernquist, B. 1998: Amber in Iron Age Finds in Sweden. Analyses and Discussions. In: B. Stjernquist, C.W. Beck, J. Bergström: *Archaeological and Scientific Studies of Amber from the Swedish Iron Age.* Scripta Minora. Studier utgivna av Kungl. Humanistiska Vetenskapssamfundet i Lund, 1994–5:1. Almqvist & Wiksell. Stockholm.

– 1999: Glass from Uppåkra: A Preliminary Study of Finds and Problems. In: B. Hårdh (ed.): *Fynden i centrum. Keramik, glas och metal från Uppåkra*. Uppåkrastudier, vol. 2. Acta Archaeological Lundensia Series in 8°, vol. 30, pp. 67–94. Almqvist & Wiksell. Stockholm.

– 2004a: A Magnificent Glass Bowl from Uppåkra. In: L. Larsson (ed.): *Continuity for Centuries. A ceremonial building and its context at Uppåkra, southern Sweden*. Uppåkrastudier, vol. 10. Acta Archaeological Lundensia Series in 8°, vol. 48, pp. 103–51. Almqvist & Wiksell. Stockholm.

– 2004b: A Glass Beaker with Cut Decoration, Found at Uppåkra. In: L. Larsson (ed.): *Continuity for Centuries. A ceremonial building and its context at Uppåkra, southern Sweden*. Uppåkrastudier, vol. 10. Acta Archaeological Lundensia Series in 8°, vol. 48, pp. 153–66. Almqvist & Wiksell. Stockholm.

Stolpe, H. 1876: Sur les Découvertes faites dans l'ile de Björkö. *Congres internationale d'Anthropologie et d'Archéologie préhistoriques*, vol. 2. Stockholm.

Strang, B.H.M., M. Brennan 1976: English Language. *The year's work English studies*, vol. 57, pp. 11–42.

Stylegar, F.-A. 2007: The Kaupang Cemeteries Revisited. In: D. Skre (ed.): *Kaupang in Skiringssal*. The Kaupang Excavation Project

Publication Series, vol. 1, pp. 65–128. Aarhus University Press. Århus.
– 2010: Hvorfor er det færre kvinne- enn mannsgraver fra Norge i vikingtid? *Primitive Tider*, vol. 12, pp. 71–9.
Sundbergh, K. 1976: Birkas brynen. Funktion och kvalitet. Unpublished thesis, University of Stockholm.
Sundbergh, K. und G. Arwidsson 1989: Schleif- und Wetzsteine. In: G. Arwidsson (ed.): *Systematische Analysen der Grabfunde*. Birka, vol. 2:3, pp. 102–10. Almqvist & Wiksell. Stockholm.
Svanberg, F. 2003: *Death Rituals in South-East Scandinavia AD 800–1000. Decolonizing the Viking Age* 2. Acta Archaeologica Lundensia, Series in 4°, vol. 24. Lund.
Svensson, M. 2001: Gyllene bronser – en komparativ kontextuell analys av Uppåkras vikingatida förgyllda bronssmycken. In: B. Hårdh (ed.): *Uppåkra. Centrum och sammanhang.* Uppåkrastudier, vol. 3. Acta archaeologica Lundensia, Series in 8°, vol. 34, pp. 239–58. Almqvist & Wiksell. Stockholm.
Tagesson, G. 2000: "Bodde dom därnere?" Om kulturlagerbildning och avfallshandtering i stormaktstidens Norrköping. In: G. Eriksdotter, S. Larsson, V. Löndahl (eds.): *Att tolka stratigrafi. Det tredje nordiska stratigrafimötet, Åland 1999*. Meddelanden från Ålands högskola, vol. 11, pp. 153–73. Mariehamn.
Tansøy, B. 2001: Fisket på Kaupang i vikingtid. Unpublished Master thesis, University of Oslo.
Taylor, J.H. 2001: *Death – the Afterlife in Ancient Egypt.* The British Museum Press. London.
Tegnér, M. 1999: Uppåkra under sen vikingatid. In: B. Hårdh (ed.): *Fynden i Centrum. Keramik, glas och metall.* Uppåkrastudier, vol. 2. Acta archaeologica Lundensia, Series in 8°, vol. 30, pp. 225–41. Almqvist & Wiksell. Stockholm.
Teichmüller, M. 1992: Organic Petrology in the service of Archaeology, International *Journal of Coal Geology*, vol. 20, pp. 1–21.
Tempelmann-Mączyńska, M. 1985: *Die Perlen der römischen Kaiserzeit und der frühen Phase der Völkerwanderungszeit im mittereuropäischen Barbaricum.* Römisch-Germanische Forschungen, vol. 43. Philipp von Zabern. Mainz.
Thieme, B. 1978–1980: Ausgewählte Metallbeigaben aus dem Gräberfeld von Ketzendorf, Kreis Stade. *Hammaburg NF*, vol. 5, pp. 65–89. Neumünster.
Thomas, G. 2001: Strap-end and the Identification of Regional Patterns in the Production and Circulation of Ornamental Metalwork in Late Anglo-Saxon and Viking-age Britain. In: M. Redknapp, N. Edwards, S. Youngs, A. Lane, J. Knight (eds.): *Pattern and Purpose in Insular Art*, pp. 39–48. Oxbow. Oxford.
Thomsen, T. 2005: Værkstedet – en bygningsarkæologisk redegjørelse. In: M. Iversen, D.E. Robinson, J. Hjermind, C. Christensen (eds.): *Viborg Søndersø 1018–1030. Arkæologi og naturvidenskab i et værkstedsområde fra vikingetid*, pp. 271–95. Viborg Stiftsmuseum. Århus.
Thörle, S. 2001: *Gleicharmige Bügelfibeln des frühen Mittelalters.* Universitätsforschungen zur prähistorischen Archäologie, vol. 81. Bonn.
Thorvildsen, K. 1951: En tylvt økser fra vikingetiden. *Aarbøger for Nordisk Oldkyndighed og Historie*, 1950, pp. 352–7.
Thunmark-Nylén, L. 1984: Ringnadel. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde*, Birka, vol. 2:1, pp. 5–14. Almqvist & Wiksell. Stockholm.
– 1995a: *Abbildungen der Grabfunde*. Die Wikingerzeit Gotlands, vol. 1. KVHAA. Stockholm.
– 1995b: Vendeltid eller vikingatid? Om datering av gotländska fornfynd kring år 800. *Tor*, vol. 27, pp. 2.
Tollnes, R. 1998: *Undersøkelser i bosetningsområdet 1956–1974. Hus og konstruksjoner.* Kaupangfunnene, vol. 3:A. Norske oldfunn, vol. 18. IAKN. Oslo.
Þorláksson, H. 1992: Social ideals and the concept of profit in thirteenth century Iceland. In: G. Pálsson (ed.): *From sagas to society. Comparative approaches to Early Iceland*, pp. 231–45. Hisarlik Press. Enfield Lock.
Tornbjerg, S.Å. 1998: Toftegård – en fundrig gård fra sen jernalder og vikingetid. In: L. Larsson, B. Hårdh (eds.): *Centrala Platser – Centrala Frågor. Samhällsstrukturen under järnåldern.* Uppåkrastudier, vol. 1. Acta archaeologica Lundensia, Series in 8°, vol. 28, pp. 217–32. Almqvist & Wiksell. Stockholm.
Treue, W. 1965 (ed.): *Das Hausbuch der Mendelschen Zwölfbrüderstiftung zu Nürnberg. Deutsche Handwerkerbilder des 15. und 16. Jahrhunderts*, vol. 2. Bruckmann. München.
Trotzig, G. 1981: Ett bildstenmotiv i arkeologisk belysning. *Gotländskt arkiv,* vol. 53, pp. 31–8.
– 1984: Gefässe aus Kupfer und Seinen Legierungen. In: G. Arwidsson (ed.): *Systematische Analysen der Gräberfunde.* Birka, vol. 2:1, pp. 219–30. Almqvist & Wiksell. Stockholm.
Tyson, R. 2000: *Medieval glass vessels found in England, c. AD 1200–1500.* Council for British Archaeology Research report, vol. 121. York.
Uboldi, M., M. Verità 2003: Scientific Analyses of Glasses from Late Antique and Early Medieval Archaeological Sites in Northern Italy. *Journal of Glass Studies*, vol. 45, pp. 115–37.
Ulbricht, I. 1978: *Die Geweihverarbeitung in*

Haitabu. Die Ausgrabungen in Haithabu, vol. 7. Wachholtz. Neumünster.
– 1990: Bernsteinverarbeitung in Haithabu. In: K. Schietzel (ed.): *Das archäologische Fundmaterial*, vol. 5. Berichte über die Ausgrabungen in Haithabu vol. 27, pp. 65–126. Wachholtz. Neumünster.
Ulriksen, J. 1998: *Anløbspladser. Besejling og bebyggelse i Denmark mellem 200 og 1100 e. Kr.* The Viking Ship Museum. Roskilde.
– 2004: Danish coastal landing places and their relation to navigation and trade. In: J. Hines, A. Lane, M. Redknap (eds.): *Land, Sea and Home,* pp. 7–26. Maney. Leeds.
Vang Petersen, P. 1991: Danefæ. *Arkæologiske udgravninger i Danmark,* 1990, pp. 180–90. Nationalmuseet, Danmarks Oldtid. København.
– 1994: Excavations at Sites of Treasure Trove Finds at Gudme. In: P.O. Nielsen, K. Randsborg, H. Thrane (eds.): *The Archaeology of Gudme and Lundeborg*, pp. 30–40. Akademisk forlag. København.
Vangstad, H. 2003: Kleberkarene fra Bryggen i Bergen. En arkeologisk analyse av kleberkarene funnet på Bryggen i Bergen fra middelalder og etterreformatorisk tid. Unpublished Master thesis, University of Bergen.
Verhulst, A. 2002: *The Carolingian Economy.* Cambridge University Press. Cambridge.
Vierck, H. 1984: Mittel- und westeuropäische Einwirkungen auf die Sachkultur von Haithabu/ Schleswig. In: H. Jankuhn, K. Schietzel, H. Reichstein (eds.): *Handelsplätze des frühen und hohen Mittelalters.* Archäologische und naturwissenschaftliche Untersuchungenan ländlichen und frühstädtischen Siedlungen im deutschenKüstengebiet vom 5. Jahrhundert v. Chr. bis zum 11. Jahrhundert n. Chr., vol. 2, pp. 366–422. Acta humaniora. Weinheim.
Vince, A. 2003: *Characterisation studies of Anglo-Saxon pottery from Lundenwic: 4) Imported wares.* AVAC Reports 2003/069. AVAC. Lincoln.
– 2006: *Characterisation Studies of Metallurgical Ceramics from Kaupang, Norway.* AVAC Reports 2006/96. AVAC. Lincoln.
– 2007a: *Characterisation of Imported Wheel-thrown White wares from Kaupang, Norway.* AVAC Reports 2007/77. AVAC. Lincoln,
– 2007b: *Characterisation Studies of Viking-Age Coarsewares from Kaupang, Norway.* AVAC Reports 2007/86. AVAC. Lincoln,
Vince, A., J. Young 2004: Artefacts and Environmental Evidence: The Period 3 Pottery. In: *Blue Bridge Lane and Fishergate House. Report on Excavations July 2000 to July 2002.* Electronic publication: http://www.archaeologicalplanningconsultancy.co.uk/mono/001/rep_ceramics_anglian.html
Vinski, Z. 1977–1978: Frühkarolingische Neufunde in Jugoslawien. *Vjesnik,* 3.Ser., vol. 10–11, pp. 190–208.
– 1983: Zu karolingischen Schwertfunden aus Jugoslawien. *Jahrbuch des Römisch-Germanischen Zentralmuseums*, vol. 30, pp. 465–501.
'Vita Caroli' The Life of Charlemagne by Einhard. Translated with an introduction by Lewis Thorpe. In: L. Thorpe (ed.): *Two lives of Charlemagne*, pp. 47–90. Penguin Classics. London, 1969.
Vogel, W. 1906: *Die Normannen und das Fränkische Reich bis zur Gründung der Normandie (799–911).* Heidelberger Abhandlungen zur mittleren und neueren Geschichte, vol. 14. Carl Winter. Heidelberg.
Wallace, P.F. 1985: The Archaeology of Viking Dublin. In: H.B. Clarke, A. Simms (eds.): *The Comparative History of Urban Origins in Non-Roman Europe: Ireland, Wales, Denmark, German, Poland and Russia from the Ninth to the Thirteenth Century*, pp. 103–46. BAR International Series, vol. 255. Oxford.
– 1992a: *The Viking Age buildings of Dublin*, vol.1:1: Text. National Museum of Ireland. Dublin.
– 1992b: *The Viking Age buildings of Dublin*, vol. 1:2: Illustrations. National Museum of Ireland. Dublin.
Wamers, E. 1981: Ein karolingischer Prunkbeschlag aus dem Römisch-Germanischen Museum, Köln. *Zeitschrift für Archäologie des Mittelalters*, vol. 9, pp. 91–128.
– 1984: Eine Zungenfibel aus dem Hafen von Haithabu. In: K. Schietzel (ed.): *Das archäologische Fundmaterial*, vol. 4. Berichte Berichte über die Ausgrabungen in Haithabu, vol. 19, pp. 63–127. Wachholtz. Neumünster.
– 1985: *Insularer Metallschmuck in wikingerzeitlichen Gräbern Nordeuropas. Untersuchungen zur skandinavischen Westexpansion.* Offa-Bücher, vol. 56. Wachholtz. Neumünster.
– 1991a: Pyxides imaginatae – Zur Ikonographie und Funktion karolingischer Silberbecher. *Germania*, vol. 69, pp. 97–152.
– 1991b: Til omarbeidelsen av insulære metallsmykker – bemerkninger til en recension. *Fornvännen*, vol. 86, pp. 110–20.
– 1993: Insular Art in Carolingian Europe – The Reception of old Ideas in a New Empire. In: J. Higgitt, M. Spearman (eds.): *The Age of Migrating Ideas: Early Medieval Art in Britain and Ireland*, pp. 35–44. National Museums of Scotland. Edinburgh.
– 1994a: *Die frühmittelalterlichen Lesefunde aus der Löhrstraße Neubau Hilton 2 in Mainz*. Mainzer Archäologische Schriften, vol. 1. Mainz.
– 1994b: Fibel und Fibeltracht. M. Karolingerzeit.

RGA, vol. 8, pp. 586–602.
– 1994c: König im Grenzland. Neue Analyse des Bootkammergrabes von Haiðaby. Mit Beiträgen von H. Drescher, E. Lietz und H. Patotzki, G. Possnert. *Acta Archaeologica*, vol. 65, pp. 1–56.
– 1998a: Ein bemerkenswerter Fund aus Vendsyssel. In: A. Wesse (ed.): *Studien zur Archäologie des Ostseeraumes. Von der Eisenzeit zum Mittelalter. Festschrift für Michael Müller-Wille*, pp. 521–8. Wachholtz. Neumünster.
– 1998b: Insular finds in Viking Age Scandinavia and the state formation of Norway. In: H.B. Clarke, M. Ní Mhaonaigh, R. Ó Floinn (eds.): *Ireland and Scandinavia in the Early Viking Age*, pp. 37–72. Four Courts Press. Dublin.
– 1998c: Tracht und Schmuck in der Wikingerzeit. In: U. Löber (ed.): *Die Wikinger.* Veröffentlichungen des Landesmuseums Koblenz, Reihe B, vol. 61, pp. 57–73. Koblenz.
– 1998d: Neu erworbene Bleimodelle im Frankfurter Museum für Vor- und Frühgeschichte. Mit einem Beitrag von Frank Berger. *Hammaburg NF*, vol. 12, pp. 89–101. Neumünster.
– 1999: Zwischen Salzburg und Oseberg. Zu Ursprung und Ikonographie des nordischen Greiftierstils. In: U. von Freeden, U. Koch, A. Wieczorek (eds.): *Völker an Nord- und Ostsee und die Franken*, pp. 195–228. Römisch-Germanische Kommission, Kolloquien zur Vor- und Frühgeschichte, vol. 3. Habelt. Bonn.
– 2000: Import, Insulare. *RGA*, vol. 15, pp. 364–9.
– 2002: The 9th century Danish-Norwegian conflict. Maritime warfare and state formation. In: A.N. Jørgensen, J. Pind, L. Jørgensen, B. Clausen (eds.): *Maritime Warfare in Northern Europe. Technology, organisation, logistics and administration 500 BC–1500 AD.* Studies in Archaeology and History, vol. 6, pp. 237–48. København.
– 2004: Kristne gjenstander i tidligvikingetidens Danmark. In: N. Lund (ed.): *Kristendommen i Danmark før 1050*, pp. 43–59. Roskilde Museums forlag. Roskilde.
– 2005a: *Die Macht des Silbers. Karolingische Schätze im Norden*. Schnell & Steiner. Regensburg.
– 2005b: Aus Onkel Emilius‘ Schublade. Ein neuer kontinentaler Beschlag aus Lolland. In: H. Eilbracht, V. Brieske, B. Grodde (eds.): *Itinera Archaeologica. Vom Neolithikum bis in die frühe Neuzeit. Festschrift für Torsten Capelle*. Internationale Archäologie Studia honoraria, vol. 22, pp. 303–13. Marie Leidorf. Rahden.
Wamser, L. 1991: Archäologisches zur Frühgeschichte Karlburgs. Ludwig Wamser, Archäologisches zur Frühgeschichte Karlburgs. In: *Gertrud in Franken.* Katalog Marmelsteiner Kabinett, vol. 6, pp. 17–26. Würzburg.
– 1992: Zur archäologischen Bedeutung der Karlburger Funde. In: J. Lenssen, L. Wamser (eds.): *1250 Jahre Bistum Würzburg. Archäologisch-historische Zeugnisse der Frühzeit*, pp. 319–43. Würzburg.
Warburg, L. 1974: *Spindebog*. Borgen. København.
Watts, S. 1996: The geological Characterisation of Jet and Jet-like Objects in Archaeology, submitted for the PhD degree, University of Bradford.
Watts, S, A.M.Pollard, G.A. Wolf 1997: Kimmeridge jet – a potential new source for British jet. *Archaeometry*, vol. 39, pp. 125–43.
Weber, M. 1966 [1921]: *The City*. The Free Press Paperback. New York.
Webster, L., J. Backhouse (eds.): *The Making of England. Anglo-Saxon art and culture, AD 600–900*. British Museum. London.
Wedepohl, K.H. 2003: *Glas in Antike und Mittelalter. Geschichte eines Werkstoffs*. Schweizerbart´sche Verlagsbuchhandlung. Stuttgart.
Wedepohl, K.H., I. Krueger, G. Hartmann 1995: Medieval Lead glass from Northwestern Europe. *Journal of Glass Studies*, vol. 37, pp. 65–82.
Welck, K. von, A. Wieczorek, H. Ament (eds.) 2006: *Die Franken. Wegbereiter Europas vor 1500 Jahren.* Philipp von Zabern. Mainz.
Werner, J. 1959: Frühkarolingische Silberohrringe von Rastede Oldenburg. *Germania,* vol. 37, pp. 172–92.
Whitehouse, D. 2003: 'Things that travelled': the surprising case of raw glass. *Early-medieval Europe*, vol. 12, pp. 301–5.
Whitfield, N. 1987: Motifs and Techniques of Celtic Filigree: are they Original? In: M. Ryan (ed.): *Ireland and Insular Art, A.D. 500–1200*, pp. 75–84. Royal Irish Academy. Dublin.
– 1993: The Filigree of the Hunterston and 'Tara' Brooches. In: M. Spearman, J. Higgitt (eds.): *The Age of Migrating Ideas. Early Medieval Art in Northern Britain and Ireland*, pp. 118–27. National Museums of Scotland. Edinburgh.
– 2001: The Earliest Filigree from Ireland. In: M. Redknapp, N. Edwards, S. Youngs, A. Lane, J. Knight (eds.): *Pattern and Purpose in Insular Art*, pp. 141–54. Oxbow. Oxford.
Wiberg, T. 1981: Glass. In: E. Schia (ed.): *Fra Christianias bygrunn. Arkeologiske utgravninger i Revierstredet 5–7, Oslo.* Riksantikvarens skrifter 4, pp. 179–89. Alvheim & Eide. Øvre Ervik.
Wieczorek, A. 1996a: Die Ausbreitung der fränkischen Herrschaft in den Rheinlanden vor und seit Chlodwig. In: K. von Welck, A. Wieczorek, H. Ament (eds.): *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 241–60. Philipp von Zabern. Mainz.
– 1996b: Identität und Integration – Zur Bevölkerungspolitik der Merowinger nach archäologischen Quellen. In: K. von Welck,

A. Wieczorek, H. Ament (eds.): *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 346–57. Philipp von Zabern. Mainz.

Wietrzichowski, F. 1990: Zur Verbreitung und Entwicklung der Sukower Gruppe in Mecklenburg. *Bodendenkmalpflege in Mecklenburg*, 1989, pp. 37–102.

Wigh, B. 2001: *Animal husbandry in the Viking Age town Birka and its hinterland*. Birka Studies, vol. 7. RAÄ. Stockholm.

Wiker, G. 2001: Utgravningsrapport for 2000 og 2001 fra forskningsgravningen i bosetningsområdet på Kaupang, gnr 1010/1029 Larvik, Vestfold. Unpublished report, KHM Archive.

– 2003: Beads from the Eary Urban Settlement at Kaupang, Vestfold, in Norway. *Viking Heritage Magazine*, vol. 2003:3, pp. 24–7.

– 2007: Monochrome blue Kaupang-beads – Local manufacture or import? In: C. Grünewald, T. Capelle (eds.): *Innere Strukturen von Siedlungen und Gräberfeldern als Spiegel gesellschaftlicher Wirklichkeit?* Veröffentlichungen der Altertumskommission für Westfalen, vol. 17, pp. 137–43. Münster.

– in prep: Glassperler fra Kaupang. PhD thesis, University of Oslo.

Wild, J.P. 1970: *Textile manufacture in the Northern Roman Provinces*. Cambridge University Press. Cambridge.

Wilson, D. 1960: The Fejø cup. *Acta Archaeologica*, vol. 31, pp. 147–73.

– 1973: The brooches. In: A. Small, C. Thomas, D.M. Wilson: *St. Ninian's Isle and its Treasure*, vol. 1, 81–105. Aberdeen University Studies Series, vol. 152. Oxford University Press. London.

– 1995: *Vikingatidens konst*. Signums svenska konsthistoria. Lund.

– 2001: The earliest animal styles of the Viking Age. In: M. Müller-Wille, L.O. Larsson (eds.): *Tiere, Menschen, Götter. Wikingerzeitliche Kunststile und ihre neuzeitliche Rezeption*, pp. 131–56. Vandenhoeck & Ruprecht. Göttingen.

Wilson, R.J.A. 1990: *Sicily under the Roman Empire. The archaeology of a Roman province, 36 BC–AD 535*. Aris & Phillips. Warminster.

Winckelmann, W. 1964: Ausgrabungen auf dem Domhof in Münster. In: A. Schröes (ed.): *Monasterium. Festschrift zum siebenhundertjährigen Weihegedächtnis des Paulus-Domes zu Münster*, pp. 25–54. Regensberg. Münster.

– 1977: Archäologische Zeugnisse zum frühmittelalterlichen Handwerk in Westfalen. *Frühmittelalterliche Studien*, vol. 11, pp. 92–126.

[without author] 1987: *Bulletin de la Société Archéologique Champanoise,* vol. 80.

Wojtasik, J. 1957: Znaleziska bursztynowe ze stanowiska 4 w Wolinie. *Materiały Zachodnio-Pomorskie*, vol 3, pp. 99–160.

– 1991: Materiały bursztynowe z Wolina-Starego Miasta (Stanowisko 1, wykopy 7 i 8). *Materiały Zachodnio-Pomorskie*, vol. 37, pp. 63–96.

– 1992: Bursztyn ze stanowisk wykopaliskowych 5, 6 oraz znaleziony luźno na Starym Mieśce w Wolinie. *Materialy Zachodnio-Pomorskie*, vol. 38, pp. 173–201.

Wolf, S., C.M. Kessler, W.B. Stern, Y. Gerber 2005: The composition and manufacture of Early-medieval coloured window glass from Sion (Valais, Switzerland) – A Roman glass-making tradition or innovative craftsmanship? *Archaeometry*, vol. 47, pp. 361–80.

Wood, I. 1996: Franken und Angelsachsen. Wieczorek, Alfried 1996: Die Ausbreitung der fränkischen Herrschaft in den Rheinlanden vor und seit Chlodwig. In: K. von Welck, A. Wieczorek, H. Ament (eds.): *Die Franken. Wegbereiter Europas vor 1500 Jahren*, pp. 341–5. Philipp von Zabern. Mainz.

Young, J., A. Vince 2009: The Anglo-Saxon Pottery. In: D. H. Evans, C. Loveluck (eds.): *Life and Economy at Early Medieval Flixborough, c. AD 600-1000: The Artefact Evidence*. Excavations at Flixborough, vol. 2. Oxbow. Oxford.

Youngs, S. (ed.) 1989: "*The Work of Angels*". *Masterpieces of Celtic Metalwork, 6th–9th centuries AD.* British Museum Press. London.

Ypey, J. 1962–3: Eine Riemenzunge mit anglokarolingischem Tierornament aus der Waal bei Rossum, Prov. Gelderland, und ein Steigbügelfragment von Huizum, Prov. Friesland. *Berichten ROB*, vol. 12–13, pp. 177–86. Amersfoort.

– 1964: Die Funde aus dem Frühmittelalterlichen Gräberfeld Huinerveld bei Putten im Museum Nairac in Barneveld. *Berichten ROB*, vol. 12–13, pp. 99–152.

Zeiten, M.K. 1997: Amulets and Amulet Use in Viking Age Denmark. *Acta Archaeologica*, vol. 68, pp. 1–74.

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